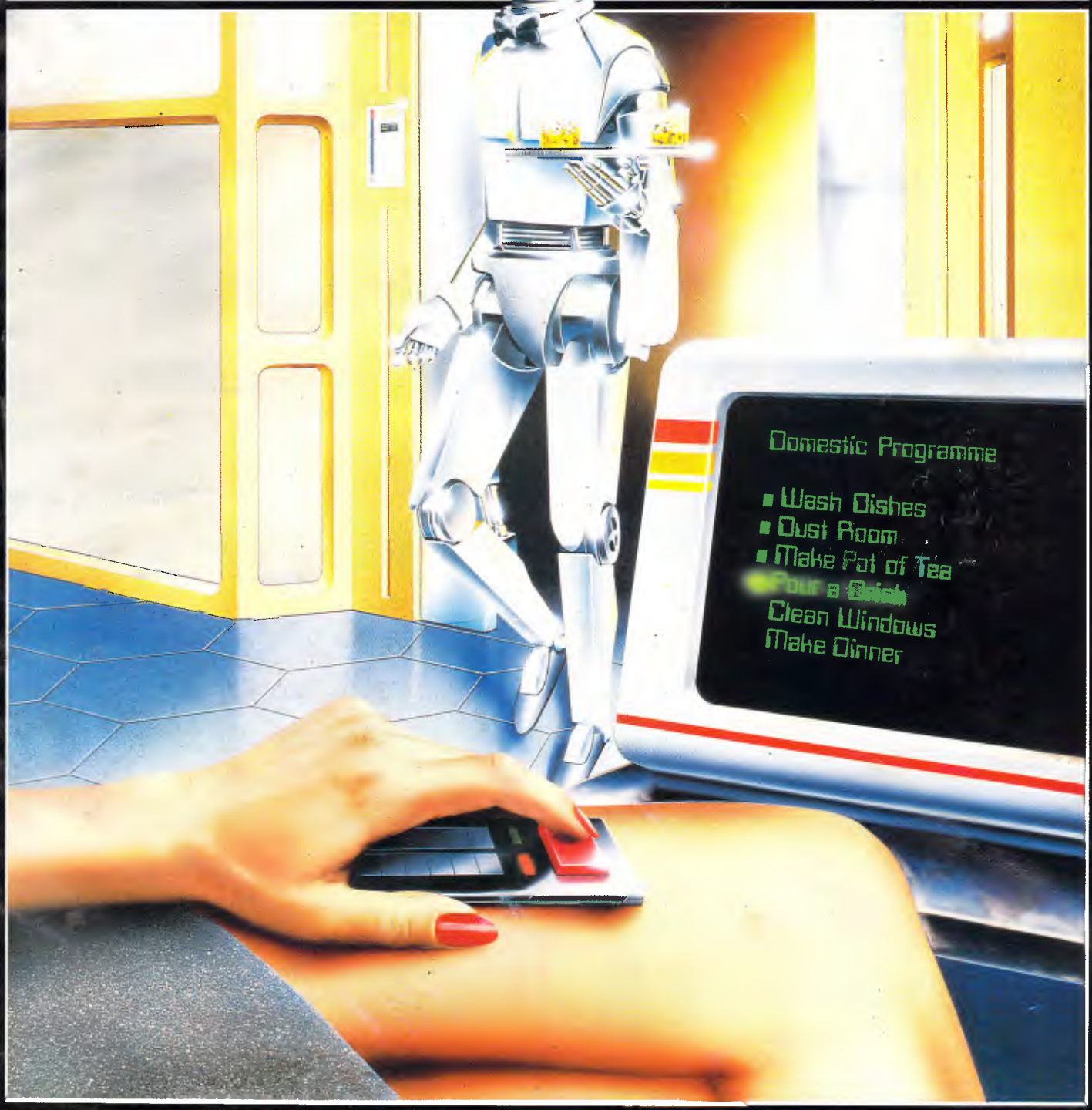
Australian Personal Computer

FREE APC SHOW CATALOGUE INCLUDED

ISSN 0725—4115 NZ $3.50
REGISTERED BY AUSTRALIA POST PUBLICATIONS VBP 3691

MARCH 1986 $3.50

AUSTRALIA'S TOP SELL[illegible] COMPUTER MAGAZINE



MAKING MICROS MORE HUMAN

Special feature includes natural languages in business and mutationary programming

NOW WITH 80286 & Z80H

Universe

Security and speed
Software compatibility, and

Forget conventional networking. Universe provides superior speed and security necessary in multiuser applications. Running the widest range of 8 and 16 bit software, it has the ability to network IBM PCs and workalikes in the fastest multiuser/ networking microcomputer system in the world.

Multiuser – efficiency
A single Universe runs up to 25 workstations, each with any combination of 8 and 16 bit programs. Advanced AED network technology allows expansion to 100's of users.

Multitasking – productivity
Each operator can use any four 8 and 16 bit programs at the same time. Switching screens takes only a single keystroke.

Networking – flexibility
Up to 255 MS-DOS machines. IBM PCs and workalikes can be linked into the Universe system using a high speed DR Net local area network.

IBM PCs and workalikes can run applications written for Concurrent PC DOS, CP/M-86 and PC-DOS, while having access to all the benefits of the network. PC users share files, records, printers and other network resources.

Software – compatibility
Dual processor design, provides access to the world's largest software base via CP/M, MP/M and MS-DOS. With AED's new Concurrent DOS you have the best of all worlds.

DMA hard discs and the new high-speed 80286/Z80H dual processor CPU furnish performance necessary to handle multiple 8 and 16 bit programs.

Tough
The Universe is built on a strong square tube frame.

Stays Cool
No fancy operating environment needed. Every Universe is tested at 42 degrees C.

Flexible
Universe accepts an extensive range of terminals, printers, modems, even electronic telex.

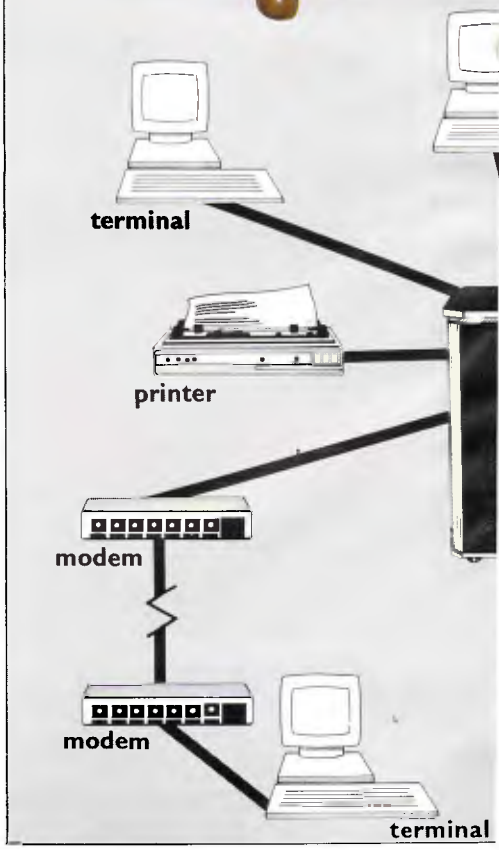
Expandable
20 slot shielded S100 buss. Obsolescence proof using IEEE 696 S100 cards.

Speed and Security – essential to your business
Most networks are slow and insecure. Universe shines here, with full multilevel security enhancements normally found on well engineered minicomputers. Universe is engineered from the ground up to provide facilities essential for the smooth running of a large multiuser system.

Important Security features
Encrypted login passwords. Users are restricted to specific terminals, directory areas, programs and nodes on the network.

File passwords. File and record lockout and a full password hierarchy. Your System Manager can quickly and easily configure the system so that each terminal only has access to those facilities and data its operator needs. For example:

- ☐ Option to restrict any account to specific programs or workstations



Multiuser

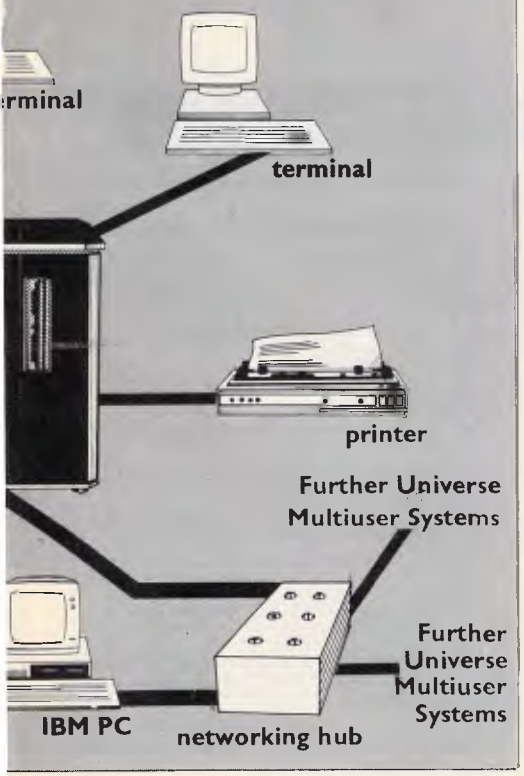
of a minicomputer. reliability of a supermicro.

Smart
Powerful file I/O processor makes Universe operation faster, leaving the CPU free of repetitive tasks.

Fast
High speed (8MHz) dual processor design (80286 plus Z80H) with options for 68000, 16032 etc.

Durable
Ebony glass top and acrylic epoxy finish

Capacity
3 Winchesters plus removeable cartridge totalling up to 300 Megabytes total storage.



- ☐ Files may be automatically dated for future reference. Optional timestamping shows both creation and last access.
- ☐ Optional passwords on computers within a local area network.

Operating features

- ☐ Low cost serial terminals support both 16 bit (CP/M, Concurrent DOS, MP/M-86) and 8-bit (CP/M, MP/M II) software
- ☐ 200 character type-ahead buffer per terminal
- ☐ Fast 'hashed' directory searches
- ☐ A secure electronic mail facility. Optional electronic Telex.
- ☐ A multiuser appointment calendar
- ☐ Optional 8087 maths coprocessor
- ☐ Inter-terminal communication. Electronic mail is here!
- ☐ A programmable keys utility so users can redefine their keyboards
- ☐ Optional telecommunications with remote computers via modem

Full Field Support

We were the first company in Australia to introduce full 12 month on-site maintenance (now extendable to 2 years at time of purchase). All service and engineering support is carried out by AED directly.

Australia wide network

Field service is presently within 24 hours on the east coast and within 48 hours for country areas.

Our network is being aggressively expanded.

Inherent high reliability and modular construction minimize downtime and make service to the most remote locations feasible.

Customer support

Our very first system buyer is still a valued customer. We take special pride in supporting every existing customer and in providing the highest standard of service at every stage. As part of this support, the Universe is continually being refined in reponse to the needs of existing customers and Australian business.

AED

NSW: AED System Developments Ltd.
Unit 3, Prospect Industrial Centre,
2 Stoddart Road, Prospect NSW 2149.
Ph: (02) 636 7677. Telex: AA 70664

The Computer Factory. 214 Harbord Road, Brookvale 2100. Ph: (02) 938 2522

ACT: AED Computers (Canberra).
217 Northbourne Ave, Canberra 2601
Ph: (062) 47 3403. Telex AA 62898

VIC: AED Computers (Melbourne).
53 Waverley Rd., East Malvern 3145.
Ph: (03) 211 5542 Telex AA 30624

WA: Computer Services of WA. 465 Canning Highway, Como 6152. PO Box 22 Como 6152.
Ph: (09) 450 5888

APC

CONTENTS

Volume 7, Number 3, March 1986

REGULARS

PROGRAMMING

BENCHTESTS & REVIEWS

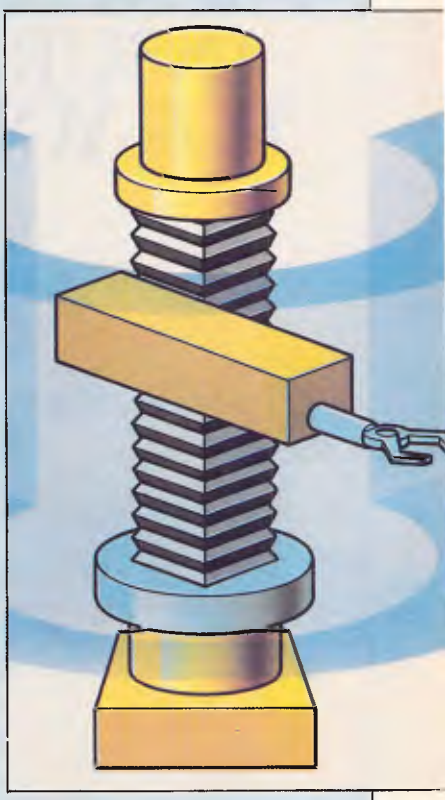
Editorial *Managing Editor* Sean Howard; *Assistant Editor* Maria Bokic; *Consultant Editors* Steve Withers, Ian Davies. **Advertising** *Advertising Manager* Mark Reiss; *NSW and Qld Sales Manager* Gerard Kohne (02) 264 1266; *Vic, SA, WA and Tas Sales Manager* Jenny Gold (03) 531 8411. **Production** Graphic Heart Pty Ltd. **Distribution** *Subscriptions Manager* Judy Welsh (02) 264 1266; *Subscription rates* Australia $35 per annum, overseas A$47.00 (surface) A$130 (airmail); *Newstand sales* Network Distribution Co. 54 Park Street, Sydney 2000. **Publishers** Computer Publications Pty Ltd (a subsidiary of Consolidated Press (Holdings) Ltd). Sydney: 215 Clarence Street, Sydney 2000; telephone (02) 264 1266; telex AA 20514 CONPRES. Melbourne: 77 Glenhuntly Road, Elwood 3184; telephone (03) 531 8411; telex AA 30333 'AMJ'.

IN BUSINESS

FEATURES

PC86 THE SIXTH AUSTRALIAN PERSONAL COMPUTER SHOW CENTREPOINT SYDNEY 12-15 MARCH 1986 PC86

ARTIFICIAL INTELLIGENCE



A 60 MBYTE BACKUP KIT FROM DANEVA... INSURANCE FOR YOUR PC.

CAPACITY 60 MBytes capacity for todays high performance Winchesters, more than enough for most high capacity disk drives.

AGILE Precision engineering and proven software guarantee rapid response during tape intensive applications.

THE COMPLETE KIT You don't need an expensive add-on or an engineer to install the PC-36.

CUSTOMER SUPPORT Trained professionals ensure a trouble free service life.

These days nobody is surprised when Daneva releases a kit that incorporates a first with new tape innovations. Daneva PC-36 tape back-up kit incorporates all the parts needed to help you install the data back-up system you need. Software, PC controller card, interconnect cables and instructions that even the chairman could follow.

But that's just half the story. Because Daneva have been supplying kits for PC's for years. In fact, our track record with Winchester and tape drive support is second to none. Our service centre is equipped with world class test equipment to check your kits. To get the full story of IBM-PC/XT® and AT® data management kits, call Daneva.

® IBM-PC/XT and AT are the registered trade marks of International Business Machines.

Distributed in Australia by:

daneva

64-66 Bay Road
Sandringham
Victoria 3191
Australia
PO Box 114
Telephone (03) 598 5622
Telex AA34439

47 Falcon Street
Crows Nest
NSW 2065
Australia
Telephone (02) 957 2464
Telex AA20801

SPONSORS OF TASKFORCE 1987

DMP002

You would imagine, after all this time and experience, that manufacturers would know what constitutes the ideal personal computer. But no — the same old mistakes are being made. Guy Kewney looks at Sony's IBM-compatible, plus all the news that is news this month.

Preparing for a fight

There is a new Atari ST on the way, with a new operating system and new Amiga-like wonderchips.

Do not believe that the so-called 1040 ST is the one you are waiting for. There is another. And it may, this year, have Commodore's Amiga DOS available, or something very close to it.

Alternative, but matching reports that Commodore's wonder machine, the Amiga, is to be fitted with the Atari operating system, CP/M 68k, have been scornfully denied by Commodore sources. 'Why would we do that?' enquired a contemptuous Gail Wellington, software development guru at Commodore, when I asked.

Well, it is an undenied fact that on the other side of the fence, Atari is certainly interested in AmigaDOS (or Tripos, as it is known outside Amiga).

Sig Hartman at Atari has been visiting software companies. He has approached Metacomco, writer of AmigaDOS, and started negotiations. He has also approached GST for 68 KOS (pronounced 'chaos'), and has approached two other sources, including one that can supply OS 9, a Unix-like system.

Rob Harding of Atari says that the policy is simple. 'We want to open up the ST to all the software that there is.'

The theory that the Atari can't run Amiga software is only partly true.

At the moment, the Amiga's internal chips give it an enormous edge over the Atari ST, and any demonstrations you may see that seem to show otherwise are so badly misleading that they come under the heading of con tricks.

But by March, the Atari will be reincarnated.

The 1040 ST announced in the US has 1Mbyte of memory. But that isn't the real 1040, as I quickly realised when talking to Atari, trying to find exactly what the difference was between the 520ST Plus (an ST with 1Mbyte of memory) and the 1040.

Investigation of the quite tangible silences in Atari's explanation proved rewarding.

The ST, like the Amiga, has a 'blitter' (a software blitter, not a hardware blitter). The blitter moves large blocks around in memory without involving the programmer (in the Amiga, it doesn't involve the central 68000 chip, either).

By March, Atari will have a hardware blitter. It will be less complex than the Amiga's, without the capabilities of logic and without the speed of the Amiga chip, but nonetheless, it will mean that some blitter-based graphics programs will, indeed, transfer from the Amiga to the Atari, with a little rewriting.

Why would Commodore try to use Tramiel Operating System (TOS)?

Well, that's simple, Gail. It isn't really TOS, it's GEM and CP/M 68k, and there's a lot of software emerging for that operating combination. Not all of it is wonderful, and some of it is useless, but there's quite a bit of it.

Now, I admit that there's a real possibility that the story is a Digital Research invention. Digital Research hasn't been reluctant to go around saying it was doing an Amiga version of GEM and CP/M 68k, in the past, even when Commodore warned it not to. It could be happening again.

But a world where Atari users can run both Atari and Amiga software, but Amiga users can only run Amiga software, isn't a world which wags the way I think it does.

AmigaDOS is taking its time becoming a standard. A major reason, I think, is that programmers are an incredibly ignorant lot about anything they aren't expert in.

You'd expect someone who's writing serious software for the 68000 to have examined the code for the Amiga's operating system and formed an expert opinion, wouldn't you? Wrong! To a man/woman/twit, they go up to a machine, type 'DIR' and wait to see what happens. Then, because AmigaDOS does a full database-type hashed index search for every file, it takes a few seconds to find the directory, and your programmer/twit says 'My my, it's slow', and passes this on as his expert opinion.

The other reason is that hardware makers are conservative, and take a long time to lumber themselves with a new operating system.

My sources suggest that Atari ST sales, worldwide, are now (the end of January) around the 100,000 mark, with Commodore more than half-way to the same figure. Both machines, whatever the

This is a thinly disguised Acme modem connected to John Sands' Sega home computer. Together, says John Sands, they become the John Sands Communications System. It can access videotex databases such as Viatel, Elders Farmlink, Microtex, and Aftel plus Teletel databases and bulletin boards.

IBM world or the Macintosh world may tell you, are doing extraordinarily well.

Cast your mind back to the arrival of the Sirius and the IBM, and remember how long it took other suppliers to adopt MS-DOS, and you'll see that AmigaDOS hasn't even begun its battle yet.

'But I think it'll be an interesting battle,' said Derek Budget, head of Metacomco. 'We're aware that Digital Research is now taking our operating system very, very seriously, which is why I believe you're hearing rumours of TOS on the Amiga. And we're getting ready for the fight.'

Guy Kewney

When will they learn?

By now, everyone who takes the business at all seriously must know that Amstrad has a cheap imitation of the IBM up its sleeve.

Details of exactly what this will be are available from many 'informed sources', and they tend not to be the same details. But they do agree on one thing — that the price will be very good indeed.

The question which I can't answer is this: since we all know about the coming Amstrad, why are some suppliers playing silly games by launching IBM PC imitations costing over $4000? Who do they think will buy them?

Sony has just announced a machine which proves just what an excellent audio company it is.

In audio, you want to make sure you have the genuine innovations, once standards have settled down, or you want to create standards in advance of other people.

So we saw Sony and Philips lead the way with compact disc music players, setting standards, but being very conservative on different varieties of Dolby noise reduction circuitry until they were proved.

The trick is to watch carefully for a year or so, and then copy the good ideas.

Watching the computer business, however, is a trap. By the time you have a good clear picture of what is going on, it's all gone somewhere else — even in the slow-moving IBM imitation world.

Sony's machine looks like a portable, lap-held machine. This gives you the advantage of being able to move it around, the company says, even taking if off the desk when you want to stop using it. It has a liquid crystal display — normally used because it requires so little electric power.

This machine also has its chips built in CMOS, a silicon process which normally lets the designer build-in battery power, since it, like the LCD screen, uses very small amounts of electric power.

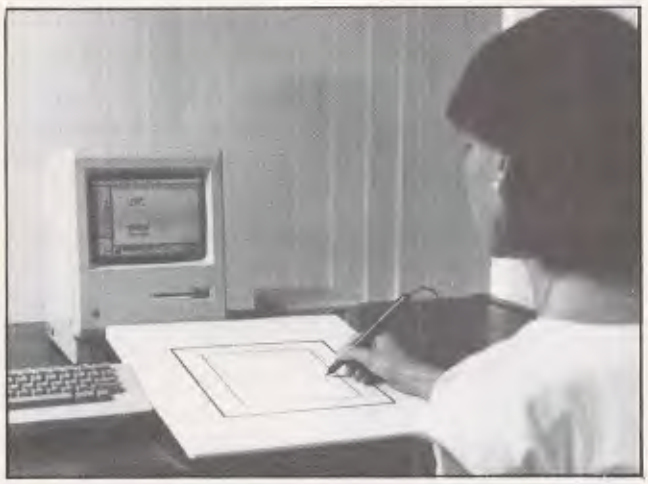
Sony, however, has decided that people don't want battery power, and to prove this, it points to the Data General One, which (it correctly points out) hasn't sold terribly well.

Leaving out the simple fact that the DG One is terribly expensive (around $8000 once you've filled it up) and is not amazingly compatible with the original IBM, and was short of software because it was a pioneer of 3.5in disks, and had a truly appalling display (only the Datavue from Quadram is worse), the DG One might still not have sold well because it wasn't promoted very heavily.

But to suggest that it didn't sell well because it had batteries, isn't even silly — it's potty, even if you try the argument that the battery power put up the price.

What we have with Sony is a machine with 3.5in disks, which IBM is just about to announce to a surprised world (may even have announced by the time you read this) and all the other drawbacks of the DG One, bar price. It is too small to fit expansion slots into, and it cannot talk to both colour and monochrome displays in different modes.

Guy Kewney



Dubbed the 'mouse alternative', this Macintizer digitizing tablet is now available in Australia through the TCG Group. Mike Barraclough of TCG says the Macintizer "allows more precision in freehand sketching, drawing and tracing than a mouse."

"A mouse is fine as a pointing device, but it does have its deficiencies. The Macintizer has overcome those difficulties and even adds performance capabilities — such as tracing maps and drawings".

TCG is in Sydney on (02) 699 8300.

Music to our ears

Sworn to secrecy, I am, but there is a manufacturer of compact disc (music) players which proposes to actually use the computer inside that little box to make the equipment you have sound better than it is.

The current designs read values off discs and generate a voltage. As the values rise, so does the voltage, and your amplifier responds.

However, your amplifier probably doesn't respond, and your loudspeakers certainly don't. They hiccup. At one moment they produce the increased voltage, at the next they suppress it, because the note they are producing isn't one they are good at. The next note, a resonant one, is far too loud.

Apparently, within two years, we will have calibrated CD players. A technician will measure output at the loudspeaker, and feed a 'correction pattern' back into the CD player. The result — smooth, even response from a fairly ordinary audio system.

I gather the problems are enormous: it isn't easy to deduce the output frequency from the digital information. A separate disk read head is required to anticipate the audio, and if the problems are large, so, too, will the price be, initially. But for perfect sound . . .

Guy Kewney

A fine line

Central America is a strange place, and as proof of this prejudiced statement, I offer the 'Institute of Artificial Insanity (™)', invented by a deadly Macintosh called Racter.

Racter is a program which

INTRODUCING
The Even Better dBASE III

dBASE III PLUS

Here's why

- Now make queries by example.
- Create views into multiple databases.
- Sort faster, index up to 10 times faster.
- Use the new pull-down-menus.
- Import and export files directly from most popular micro software packages.
- Protect your files with passwords and encryption.
- Use the many new commands and dBASE language extensions.
- Get a complete manual and new disks.

Become multi-user with file and program sharing over LAN's. Full file and record locking is provided.

ASHTON·TATE

☐ Tell me how I can exchange my current dBASE III to dBASE III Plus

☐ Tell me more about dBASE III Plus

☐ Tell me about the LAN Pack

**dBASE III Plus requires an IBM PC, XT, AT or close compatible. The networks currently supported are IBM PC Network, Novelle Advanced Netware, and 3Comm Ether Plus.*

Name_____

Address_____

AUSTRALIA'S LEADING SOFTWARE DISTRIBUTOR

arcompacific

BRISBANE MELBOURNE SYDNEY HAMILTON (NZ)

Freepost 2, P.O. Box 13, Clayfield, Qld. 4065.

produces speech — well, English words, at any rate.

To quote from the announcement by Mindscape Inc of Northbrook, Illinois: 'Asked if he believes in the power of speech, Racter said, "No, believing is like feeling. Ha ha, ha. This'll break you up, simmer down . . . belief is sceptical."'

During a conversation (?), Racter (short for raconteur, apparently) stores some of the user's own words, and phrases and re-inserts them into the dialogue, just as humans do. They do, they do, but this is ridiculous.

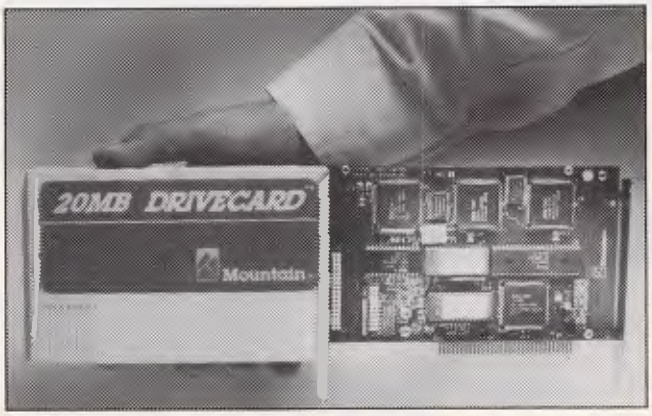
How about: 'Racter is the first computer program to write a book, *The Policeman's Beard is Half Constructed* (Warner, $9.95).'

Or the promotional notion of the club for the first million buyers of the program — the Institute of Artificial Insanity — to enter, and submit your photograph 'before' and 'after' using Racter.

MindScape justifies this craziness with the suggestion that the $45 package fulfils a real need. 'What the world really needs,' it says, 'is a computer that could entertain at parties.'

I suggest that we leave this here, before it takes over. Apparently, the Macintosh version, unlike its predecessors on the Apple II and the IBM PC, actually has a voice.

Details, for those with splendid confidence in their own mental stability, in the US on (312) 480 7667.



This is one of several hard-disk-on-a-card products. Dubbed the Drivecard, it stores 20Mb on a 3.5 inch drive, weighs around one kilogram and uses only 14 watts, so it shouldn't strain the IBM PC's (or compatible's) power supply too much.

It retails for $2365. Details are on (02) 819 6811.

If the headline fits . . .

It was my misfortune to meet a former contributor to *APC* at a recent microcomputer exhibition. 'I do hope,' said Peter Rodwell happily, 'that you will get the right headline on the story about that Texas-based micro dealer network.'

Dealer network? Did he mean Tandy's chain of stores?

'Indeed. You will have to write about the break-up between Apricot and Tandy, with the collapse of the AT Computerworld chain,' said Rodwell. 'You can call it . . .'

We will not call it the Texas Chain Store Massacre, Rodwell.

Guy Kewney

Briefs

Try as they might, manufacturers, with the obvious exception of Apple with its Macintosh, have failed to significantly reduce the average PC's footprint. Couple this with the PC users' average capacity for untidiness and you've got the ingredients of the idea for the Computer Companion — according to Debden Associates.

The product is a three-ring binder which replaces loose notes, slips of paper and "memorisation"; it also contains several disk storage pouches, weekly calendar and directory of personal contacts. The distributor, Debden Associates, is on (03) 645 1888 . . .

Microtex has announced that listings from *APC* written in Microsoft Basic, where the program is not specifically written for a particular PC, will be stored in 'untokenised' form so that owners of a wide variety of machines can run the programs . . .

This month's foot-in-mouth press release award goes to Gould Public Relations for producing a statement headed "Macintosh Sybiz Release Nearer". In the first paragraph of

MEMOREX

Disks

COLOURFUL IN BLACK

For More Information Call Memorex TOLL FREE 008-226117 or Sydney 908-2211 Melbourne 267-2955
New Zealand: Dataset Computer Supplies (N.Z.) Ltd. Auckland 795-561 Wellington 857-686

the release: "The eagerly sought-after Macintosh Sybiz version of Australia's popular integrated accounting software is now released, with orders being taken" . . .

Digital Research's concurrent PC-DOS has been modified to recognise Intel's Above Board PC memory expansion package and should be available from late March . . . Last month we may have given a wrong impression about an Australian authoring system (page 21, Feb *APC*). The news item stated that the authoring system "allowed teachers to develop and deliver interactive videodisc sequences, speech synthesis, music and colour graphics". All this is correct but you don't *have* to have all these goodies to use the system; a good old PC will do — but the system is capable of using the additional peripherals if they're available . . .

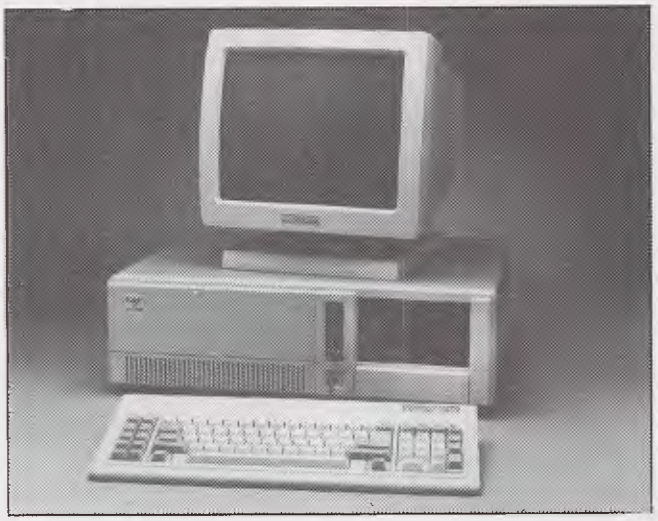
A series of seminars, emphasising the use of pocket computers in tertiary education and in scientific applications is being conducted in March by Sharp. Brisbane, Sydney, Melbourne and Adelaide are each to have the one day seminars. Call Tony Prince on (02) 728 9111 for venues . . . Executive Software is claiming to sell latest-release software at discount prices. Produce is distributed by mail and machines catered for include the IBM PC, Apple II and Commodore 64/128. Call toll-free (008) 22 6622 (or in Sydney, 438 4252) for a free catalogue . . .

Stock Executive is an Australian developed portfolio management system incorporating facilities to allow the setting of 'target' and 'stop loss' limits on shares. As Australian tax laws change, the package will be appropriately updated. It runs only on MS-DOS systems at present but is being developed for other systems. Arcom Pacific distributes it, and it retails for $249. A $10 demonstration disk is also available . . .

A new version of the advanced word processor, XyWrite (version III), is now available from Kowhai Systems. Some of the new features in this latest release are: the ability to produce multi-column documents (up to six per page); multi-font width tables for true proportional spacing; up to nine file simultaneous editing; automatic hyphenation; file comparison (to see where two files do and don't match); and the facility to produce double-sided pages by printing even pages only and then odd pages. Full details are available from Kowhai on (02) 546 6499 . . . Last month's review of the Smart Answering Machine contained a major error. The unit sells for $899, not $1900 as stated in the review . . .

The PC Turbocharger is a go-faster board for the IBM PC. It consists of an 8086 and 8087 processors and 640k of RAM and provides print spooling, disk cache, a RAMdisk and a claimed three fold execution speed of BasicA. It sells for $1800. Details on (03) 537 2786 . . . Another board, the IT-3 Accelerator — this time for the IBM PC/AT claims an increase in processing speed of 33%. It retails for $198, including installation. Call (02) 816 2700 . . .

Printworks is a menu-driven printing utility for IBM PCs and compatibles. Among its features designed to make printers easier to use is the ability to print documents sideways, and create custom characters and logos. For details of its capabilities call PC Extras on (02) 319 2155.



The PC Master, pictured here, is Pantek's PC/AT compatible. It's produced in Taiwan by one of those companies that is just a name to the Australian buying public. So to introduce you to CAF Computer Corporation, here's its history according to the announcement heralding the PC Master.

"The Pantek came about via the Taiwanese government's research organization — ERSO (the Electronic Research and Service Organization) who developed a compatible computer without violating IBM's copyrights. After the ERSO design was completed, the construction of the Pantek was placed with three organizations who formed a separate company for the manufacture. This company was called the CAF Computer Corporation which is an acronym for the name of the three companies involved. The companies are: China Data Processing Centre (the C), Advanced Datum Information (the A) and Fontex Technology (the F)."

Fascinating!?

Well the interesting bit is none of the above, It concerns the PC Master's price. Well 'prices' actually, because it's also being sold in body, if not in name, by Osborne Australia as well as Pantek Australia.

Pantek's price: $4895. And Osborne's: $5100. Interesting, eh?

Watch for some pricing shuffles.

Pirate sails off

The action against Down Under Software (a Melbourne-based firm found by *APC*'s sister publication, *Computing Australia*, to be selling pirated software) appears to have largely fizzled out following Imagineering's decision not to take punitive action against the firm. Jodee Rich, managing director of Imagineering, said that "we have taken legal action and those demands have been met. A written undertaking was made not to pirate software. We are still currently investigating and if we hear of further piracy, legal action will be taken."

Cheap speed

The table on the following page shows the increase in speed of execution of *APC*'s benchmark programs using PC-Speed from Commercial and Professional Microsystems. The test was done on a PC Pro from MicroBuff and shows a substantial increase in the average execution time of the benchmark routines from 15.7 to 9.44 seconds. The PC Pro is itself slightly faster than an IBM PC, so IBM

NEWSPRINT

owners could look forward to a virtual doubling of processor execution speed with this $492 unit. For more information call (03) 267 7829. END

	Standard	*With PC-Speed installed*
BM1	1.16	.75
BM2	4.78	2.93
BM3	10.22	6.28
BM4	10.66	6.57
BM5	11.50	7.12
BM6	20.87	12.44
BM7	32.16	19.31
BM8	34.25	20.16
Average	15.7	9.44

On with the show

Stuart Kennedy scours through pre-show publicity to detail the main attractions at PC86 — The Sixth Australian Personal Computer Show.

The Sixth Australian Personal Computer Show will be a many splendoured thing.

Mean and clean new computers, packing more silicon horsepower for the dollar than Peter Brook puts into his stomping Commodore V8's.

Software to blow the underpants off even the most jaded, WordStar-damaged mind.

And peripherals. Ahh, the peripherals! Printers, plotters, heady hard disk drives, graphics tablets, speech synthesisers and a mice plague big enough to make western NSW's last year look trivial.

The computer clubs will also be there. The PC86 organisers give the clubs a fair go by supplying free booth space.

If you use a PC and find it hard to keep track of all the discoveries being made about what your machine can do for you, then it's probably time you looked into joining a club.

What these attractions add up to is simple: the greatest exposition of microcomputers, things to stick in them and things to hang off them, to be seen south of the equator.

For those of you wary about coming along and seeing row upon row of computer games, forget it — this is a business show.

As Graeme Selby managing director of Australian Exhibition Services puts it: "Everyday is business day at PC86".

Don't believe me? Well let's take a look at who and what is going to be there.

Main attractions

To my mind, the star hardware attraction of the whole shebang will be the Commodore Amiga.

Don't laugh, Commodore is deadly serious about this machine and what it can do for the business user wanting more creative applications out of his/her PC than just spreadsheets, databases and word processing.

The Amiga, for those hermits who haven't heard, is a Motorola 68000-based boom box featuring 512k RAM, a 3.5in disk drive and some of the shrewdest graphics and sound technology to be had for under $10,000, or $3,000 for that matter. I have an inside tip from Commodore that the machine will retail for $2,900 in Australia, give or take a hundred dollars.

Using a neat piece of silicon called a blitter, the Amiga can move binary strings around in memory very quickly making for extremely smooth animation.

To my mind, the star hardware attraction of the whole shebang will be the Commodore Amiga.

To disprove those who believe that the Amiga market is a software desert, Commodore will also be showing some 70 Amiga software packages, most of them geared to the business user.

Commodore will also be showing off the new 128D. This is a transportable version of the 128 (with a built-in 1570 disk drive) that folds up into a carry case similar to the old Commodore Executive.

Not to be outdone by Commodore, Apple will have the Macintosh Plus. This is the machine Mac addicts should have had all along. A faster 800k disk drive, 1Mbytes of RAM expandable to 4Mbytes, a keyboard with a numeric pad and twice as much operating system ROM. The Mac Plus has 128k as compared to 64k on the old Mac.

The Finder program which manages the desktop is now held completely in RAM which speeds up the desktop.

The Apple stand will also feature the latest Apple II peripherals, including the 3.5in 800k Uni Drive and a 1Mbytes RAM board.

Don't miss Apple's LaserWriter Plus either. Anyone used to the noisy, dotty world of dot matrix printers will be amazed by the resolution, quietness and speed of the LaserWriter.

The LaserWriter can do 300 dots per inch and has 35 different typefaces. Mind you, this sort of printing performance doesn't come cheap.

Wander over to Hewlett-Packard's stand and check out the Vectra. This is a 30% IBM AT compatible — 30% faster, 30% smaller and 30% lighter than Big Blue's muscle PC.

The Vectra features HP's Human Interface Loop which allows you to hook up the optional mouse, graphics tablet and touchscreen without wasting any valuable expansion slots.

HP will also have its full range of six and eight pen plotters, ThinkJet/LaserJet printers and software on display.

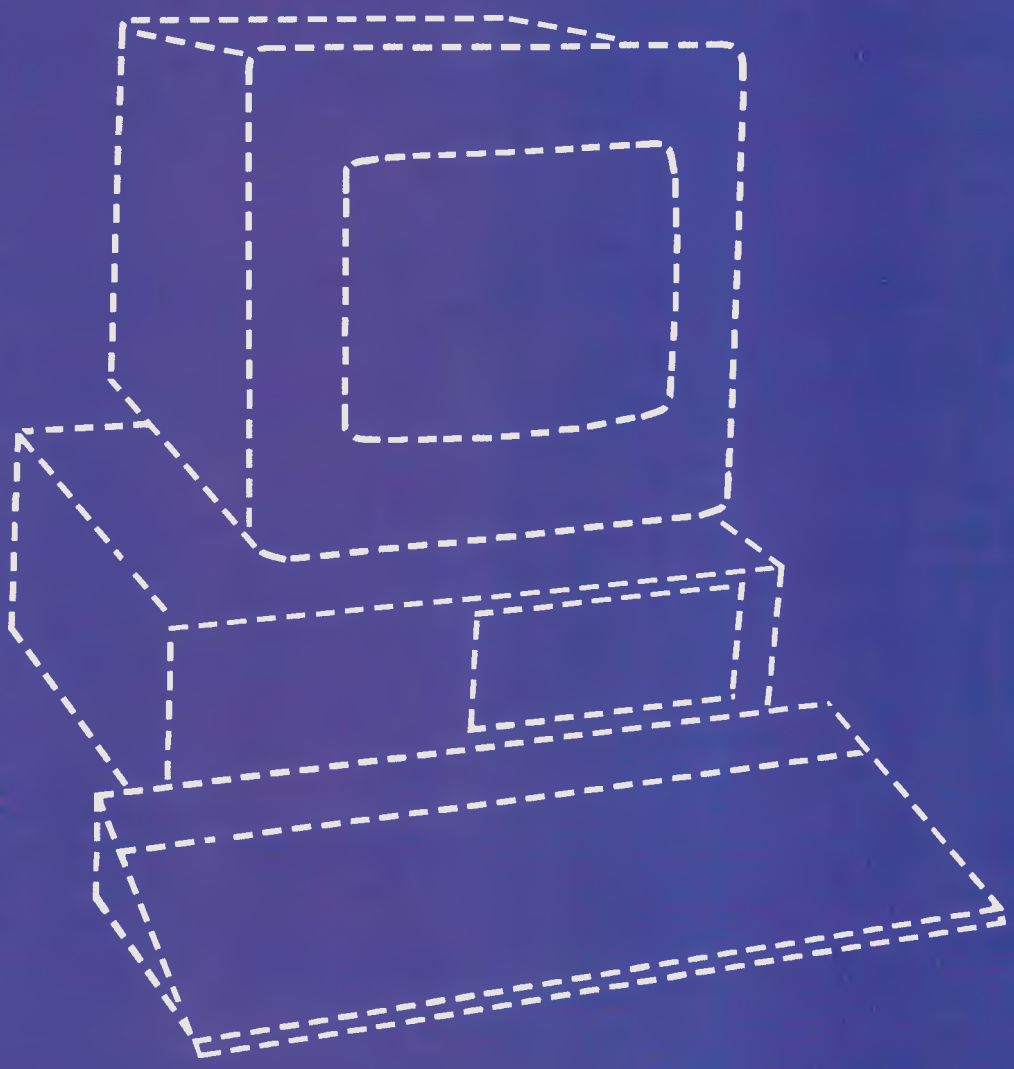
The three biggest and most influential letters in all computerdom, IBM, will be making a centrepoint in Centrepoint.

IBM will have its entire PC range — AT, XT, PC and JX — all running top applications software. These will range from Attache accountancy software for the beancounters, to Salt Bush software for the men and women on the land.

If expansion of your system is on the cards, then you'll find the options at PC86.

How about a Color Jetprinter or the oh-so-silent Quietwriter or the top print quality Wheelprinter? Can't decide? Then check them all out at PC86.

If you are into Zen then Barson Computers Australasia can show you



THE PERFECT PERSONAL COMPUTER FOR YOU HASN'T BEEN BUILT YET.

mighty Apricot XEN. This beast can be expanded into a shining example of computer mastery with 5Mbytes of RAM and up to 40Mbytes of hard disk.

Barson will also have the rest of the Apricot tree on display including the F2, F10, twin 720k floppy PC and the Xi10.

The BBC Master Series will be there. This is a range of five Beebs specifically configured for middle to higher educational, scientific and business applications.

Have a look down the barrel of Canon's stand and see the Bubble Jet and Laser printer (the Canon Laser Engine is the industry standard).

Ericsson prides itself on ergonomics — this is the selling point on the Ericsson line of IBM compatibles. These PCs are more adjustable than a monkey wrench and if you can't make one fit your body and your workspace then there is something seriously wrong. And not with the Ericsson.

The Ericsson workstations feature amber filter screens for tired eyes and a fully adjustable ergo arm mounting point. The company will also display its new Portable PC which weighs in at a svelte 7.6kgs.

The little Aussie battler, 8-bit MicroBee computers will be the best buzz on the MicroBee Systems stand, (formerly Applied Technology).

The latest Premium Series Bees have colour, built-in Viatel/Videotex communications capability and enhanced hi-res graphics. As part of MicroBee Systems continuing policy of not leaving users in the lurch when new products come out, older Bees can be upgraded to Premium Series level.

Olivetti's stand will have an improved version of the slick and speedy M24 compatible. The new machine is called the M24SP and has a faster CPU, a more powerful disk controller, more memory and the true way into higher digital sprituality with the some extra razzle in the video circuitry.

If you want an Olivetti on your lap then look at the M22. This Italian job lap-top has disk compatibility with its brother M24.

The company has some "revolutionary" small business software in the wings which it is keeping under wraps until the Show.

National Panasonic — say Panasonic in the office — has a transportable worth a peek at, called the Executive Partner.

This box has the lot — a 60 cps thermal printer, dual 360k drives, an 8086-2 CPU and, best of all, a high resolution gas plasma display for those mobile keyboard tappers who actually like to read what they are typing.

Amstrad afficionados will no doubt descend in their legions onto the Mitsubishi Electric AWA stand. The whole Amstrad range will be on display, with the centrepiece being the PCW 8256 which could very well be the last word in 8-bit technology micros.

Peripherals

Minicomp, which has made a name for itself selling Unix-based technology, will have its line of Summagraphics Microgrid digitisers at the show.

Also on display will be the MACTablet which is a digitising pad specifically designed for the Apple Macintosh.

Microsoft will have the legendary Bill Gates in town for the Show and it's expected that he will pitch in on the Microsoft stand at some stage. It's not everyday you can have a chance to mince algorithms with the Steve Jobs of microcomputer software.

Arriving with Bill Gates will be Microsoft Windows — who said "about time"? This is the product that banishes the distinctly dull A> prompt from an MS-DOS machine and replaces it with pull down menus, windows, an optional mouse, trash cans and clocks as well as an applications switcher.

Besides Windows, there will be Microsoft's latest power database package for the IBM PC and compatibles — R-Base 5000.

Microsoft's Macintosh customers need not feel neglected as demonstrations of Excel, Chart, Word, File and Multiplan will be available.

Imagineering and Arcom Pacific will be throwing their two new database products in the ring — dBase III Plus from Arcom and Paradox from Imagineering.

Paradox was written by a US company called Ansa which was started with venture capital from the man with the high-tech Midas touch, Ben Rosen.

Jodee Rich, Imagineering's managing director, has said that Paradox is the major release from his company this year.

Rosen is the money man behind Lotus Development and Compaq, so Paradox has some illustrious predecessors.

The package has a powerful interactive query system, the ability to import and export data to Lotus 1-2-3, Symphony and others as well as its own application generating language.

The big news with dBase III Plus is that it is now multi-user, which makes it instantly attractive to corporate users. The latest dBase also has had a user friendly applications generator added on.

Imagineering will also be releasing version 2 of Lotus 1-2-3 which can make use of the extra memory available on the IBM PC/AT and close compatibles.

Arcom Pacific, has more software to show off besides dbase III Plus.

These include Framework II, Torrington Manager Mouse and Stock Executive.

So there you have it, a quick preview zip around the traps at PC86 — the palace of personal computer splendors.

Hewlett-Packard will build yours after consulting the expert – you.

Announcing the Vectra PC concept – true flexibility to tailor the perfect solution to your needs.

Because in business, no two individuals have exactly the same needs, Vectra has been created to allow you to buy a PC tailored to suit your specific requirements. It offers enormous scope in terms of hardware and software applications and enables you to select the power, speed and memory capabilities that are right for you. Plus you have the option of using the Touchscreen facility or HP Mouse.

As Vectra is compatible with the IBM PC/AT, you can choose from thousands of popular business software programs – right off the shelf.

Vectra is the powerful PC that can grow with you. Its modular design means that future system expansion will be easy.

Vectra is so flexible it can be virtually anything you want it to be. Its arrival presents an ideal opportunity for you to invest in HP's renowned technical excellence at a competitive price.

Find out how the Vectra PC can fit your needs by calling your local authorized Hewlett-Packard dealer or Hewlett-Packard direct.
Melbourne (03) 8952895 Sydney (02) 8884444
Adelaide (08) 2725911 Perth (09) 3832188
Brisbane (07) 304133 Canberra (062) 804244

Vectra
HEWLETT
PACKARD

NORFOLK HELPS YOU GET IT WHILE IT'S HOT

Buy any of the wide range of NEC's computers and printers from Norfolk before 31st March, 1986 and you could win a Toyota Seca CSX Sedan.

Over the last 15 years Norfolk have become recognised as the leading professionals supplying the latest computer technology and back up services to Australia's top companies.

Together with NEC we are giving you the chance to win a Toyota Seca CSX when you buy any of the wide range of NEC products like the fabulous NEC P5 Dot Matrix printer shown.

The NEC P5 is the clear leader in its class, with outstanding features and high speed "near-letter-quality" output.

Norfolk are supplying these printers at Australia's best prices and offer the most professional service & support.

PHONE US WHILE ITS STILL HOT SYD: 02 922 3544 MEL: 03 690 5288

NORFOLK

DATA INTERNATIONAL Pty. Limited

PC86 PROUDLY ANNOUNCES

A $2 RIP-OFF.

You'd be mad to pay the full $5 for a ticket to PC86 — especially when you can rip us off for $2 just by ripping out one of these vouchers and presenting it at the door. PC86 — The definitive personal computer show. Centrepoint, Sydney: Wednesday-Friday, 10am-7pm Saturday 10am-5pm. See you there.

Send this page to us now and we'll send you over 35,000 PC buyers next June.

Fold here

Big time PC buyers. Professional business people seriously interested in what you have to offer.

Australian Exhibition Services' highly acclaimed PC Shows have a reputation for attracting over 25,000 of these people every year.

And next year, our numbers will be way up. Because for the first time, the PC86 Show will join forces with two other major exhibitions – Communications 86 and Office Technology 86 – making it the biggest business technology show ever staged in Australia.

And the biggest marketing coup you'll stage in '86.

Fold here

Obviously, space is at a premium. So secure your top position now. Send us this page and we'll send you colour brochures outlining space rates and details of services provided. Your name on this coupon does not represent a commitment of any kind on your part.

Send to: Australian Exhibition Services Pty Ltd Suite 3.3 Illoura Plaza
424 St Kilda Road Melbourne Victoria 3004
Telex AA39329 Telephone (03) 267 4500

THE SEVENTH AUSTRALIAN
PERSONAL COMPUTER SHOW
ROYAL EXHIBITION BUILDING
PC Show 86
MELBOURNE 1-4 JUNE 1986

Please print in block capitals:

Company .....

Address .....

..... Postcode .....

Contact ..... Title .....

Telephone ..... Telex .....

General description of products to be exhibited .....

.....

IN CONJUNCTION WITH COMMUNICATIONS 86 AND OFFICE TECHNOLOGY 86

AES 666

Take the gamble out of training

The excitement of new hardware and software soon starts to ebb when you don't know how to work it. Kester Cranswick reports on what training is available when the documentation falls short of the mark.

Choosing and buying anything to do with computers is the easy part. The fun really starts when you get to your desk, open up all the boxes, plug in the cables, flick the switch and scratch your head. Unless you are gifted with the genius of Einstein and the intuition of Nostradamus, you'll turn into a gibbering idiot trying to understand how everything works.

"Aha," you say, "there is a manual." Three sleepless nights later you know how to run a demo, and how to crash the system, but you haven't got a clue what an ambiguous file search is. The truth of the matter is that documentation is usually about as clear as mud.

The 1985 *APC* award for documentation went to the Ericsson PC, but the judges made it clear that most documentation still had a long way to go. There are rare exceptions, but finding them is like finding an honest politician.

So, you look elsewhere for help. Visit the dealer, if he is still in business. He might help with a specific question, but asking how to work your computer won't get a helpful response. Ringing suppliers and magazines other than *APC* will give about the same level of help.

If you want to get the picture, read a thousand words — every day for the rest of your life. Books, purchased or borrowed, can answer the fundamentals and the fine points. But, it all depends on what you want to know, and how much you know already.

A stroll down to the Technical Book & Magazine Company will show you that there are literally hundreds of technical books to read, from 'What is a Computer' level to 'Fibre-optics in the RPG Environment.' If you have a PC, clone or a popular home micro, you'll find plenty of reading matter to introduce you to your new acquisition. As you get to know it, you'll not run short of books to buy. Authors get rich on ignorance.

The Technical Book & Magazine Company recommends a number of titles. For getting to know a PC, 'Running MS-DOS' by Van Wolverton, and Peter Norton's 'Programmer's Guide to the IBM PC' are selling well. Books on Turbo Pascal, such as 'Introduction to Turbo Pascal' by Stivison, are getting a lot of attention too.

If it is software that has you stumped, you can get written assistance too. Providing, that is, that you have lemming-like followed the herd and bought a package such as Lotus 1-2-3, WordStar or dBaseIII. If you were foolish enough to buy something obscure, you had better hope the manual was good.

The 1985 APC award for documentation went to the Ericsson PC, but the judges made it clear that most documentation still had a long way to go.

Software-specific best sellers include 'Advanced Programmer's Guide to dBaseII and III' (Castro and others), 'Guide to Using Lotus 1-2-3' (Baras) and 'Introduction to WordStar' (Naiman).

Books can only take you so far. They contain plenty of theory, but they can't talk to you. And, some people just can't get to grips with the old Caxton birds. Books need TV screens and people to learn something.

Cassettes are a variation on the book approach. The voice of a tutor guides you through a program, and there are printed lesson summaries supplied. Assco, in Adelaide, sells three and four cassette packs introducing popular home and business computers, MS-DOS and CP/M, 1-2-3, Symphony, Framework, Multiplan, dBaseIII, WordStar and other popular applications. Cassette sets cost around $100 each.

On screen

If you have figured out how to load a program, a tutorial program might be of help. These types of teaching devices fall under the catchphrase of Computer Based Training. CBT is anything that teaches you to use a computer by using a computer.

A typical tutorial program will deal either with an operating system or a popular program. It will run through the main commands, pausing at various points so the student can key in a response. As the lesson progresses, there may be tests, and the material gets more complex. Menu options allow the student to return to, or skip over material as desired and supporting documentation may be supplied.

Probably the largest library of CBT material belongs to ASI, Advanced Systems Australasia, with offices in Melbourne and Sydney. A set of disks for a PC and reference material costs around $150. There are approximately one thousand courses available, and with a number like that, you can expect to find something for every need. As a sign of how good the courses are, ASI's Melbourne secretary uses Multimate


JOHN SPIRES
AV

and has never had to refer to anything other than the ASI courseware.

A look through the ASI catalogue shows courses on popular software packages, text editing at three levels, Basic and management. There are CBT courses for mainframes too, on most operating systems and programming.

CBT still has a long way to go. With the advances being made in expert systems, we will eventually be able to get tutorials that 'learn' a student's strengths and weaknesses, and construct lesson flow around these. Such things are still a little way off at the moment.

Press 'play' button

A different tack is video training. There are two forms of this. "Video should not be regarded as just a video tape. It is a structured learning system," says ASI Director, Geoff Bransbury. "It is far superior to computer based training for putting concepts across. A picture is worth a thousand words."

Standard videos can be purchased to teach almost any computerised topic you wish. They are mostly American productions. A company such as ASI has about 3,000 videos in its catalogue, with subjects ranging from an introduction to computers, to tutorials on popular software, and programming in specific mainframe operating systems. Video courses cost about $150 each. Switch on the video, run it through and learn.

The best videos involve the student. They may ask the viewer to duplicate something on his or her keyboard, showing the results that should be achieved. And they can be rewound or fast forwarded as the user wishes. What is to be avoided are videos that simply teach insomniacs how to snore.

Interactive videodisks are a relatively new idea, and aimed at the corporate user. The videodisk shows a video image on a monitor, but it allows user interaction too. The viewer can, at certain points, branch the program to certain points by keying choices on a menu.

This means that a lesson can be more individual, skipping over areas that a student already knows, and repeating the difficult bits. It is video, but with the flexibility of a CAI (Computer Assisted Instruction) device. Says Bransbury, "Interactive video is the Rolls Royce medium, merging CBT with video."

Unfortunately, videodisk players are expensive. Videodisks mainly cover tutorials in popular software packages at the moment, but an increasing variety of American videodisks are becoming available which teach very advanced topics. A company can thus invest in a videodisk unit, and train as many people as necessary with the one disk.

Syslink is another company in the videodisk business, operating in Sydney and Melbourne. Hire of the player and course costs around $500 per week, and a course takes six to eight hours to complete. Six people could be trained in a week.

Videodisks, tutorial programs and videos offer the convenience of students being able to learn where they want, when they want, and at the speed they want; but they suffer the disadvantage of being restricted to a single work-station.

As you get to know it, you'll not run short of books to buy. Authors get rich on ignorance.

So, despite such technological wonders, the most popular means of training is the training seminar, with an expert lecturing to one or many students.

Computer courses

These courses are run by almost every adult education college, university and scores of private companies. You'll see them advertised in the media, from your local newspaper to computer trade magazines.

They all have the same basic approach. For a fee, an expert will address a class, with students usually sitting in front of a computer and doing what they are told. Courses can run from half a day to a week or longer, depending on the subject matter.

The best videos involve the student. They may ask the viewer to duplicate something on his or her keyboard, showing the results that should be achieved.

Picking the right course for you or your company is the hard part. With merely a course title and price to go by, you might easily find yourself in a course that is pitched at the wrong level, has a poor tutor and no course notes.

Decide on what you want to learn first. That will enable you to pick a course at the level suitable to you. Then decide how much time and money you can afford to spend.

If funds are tight, adult education is the best path to follow. Almost all Tafe colleges will run evening courses with very modest costs. The subject matter covered is usually an introduction to computers, programming in Basic, and popular programs such as WordStar and 1-2-3. You can get better training, but you won't get better value.

Some colleges run more advanced and more expensive evening courses through their computing departments. For instance, the Chisholm Institute of Technology runs ten week courses in Cobol, C and Fortran programming, data communications, fourth generation languages and more. These courses cost a couple of hundred dollars each, and involve real study, but could be the first step to a new career.

If you are willing to spend $100 or more a day, then you can afford to go to one of the many institutions offering professional seminars. Such companies are found in every major capital city, with the majority in Sydney and Melbourne.

They cater for the corporate market, as companies using computers are quite willing to spend lots of money to train their staff. Virtually every company runs an introduction to micros course, plus the old standbys of 1-2-3 and Symphony. In fact, if you scout around, you will find a wide range of popular software covered at one place or another.

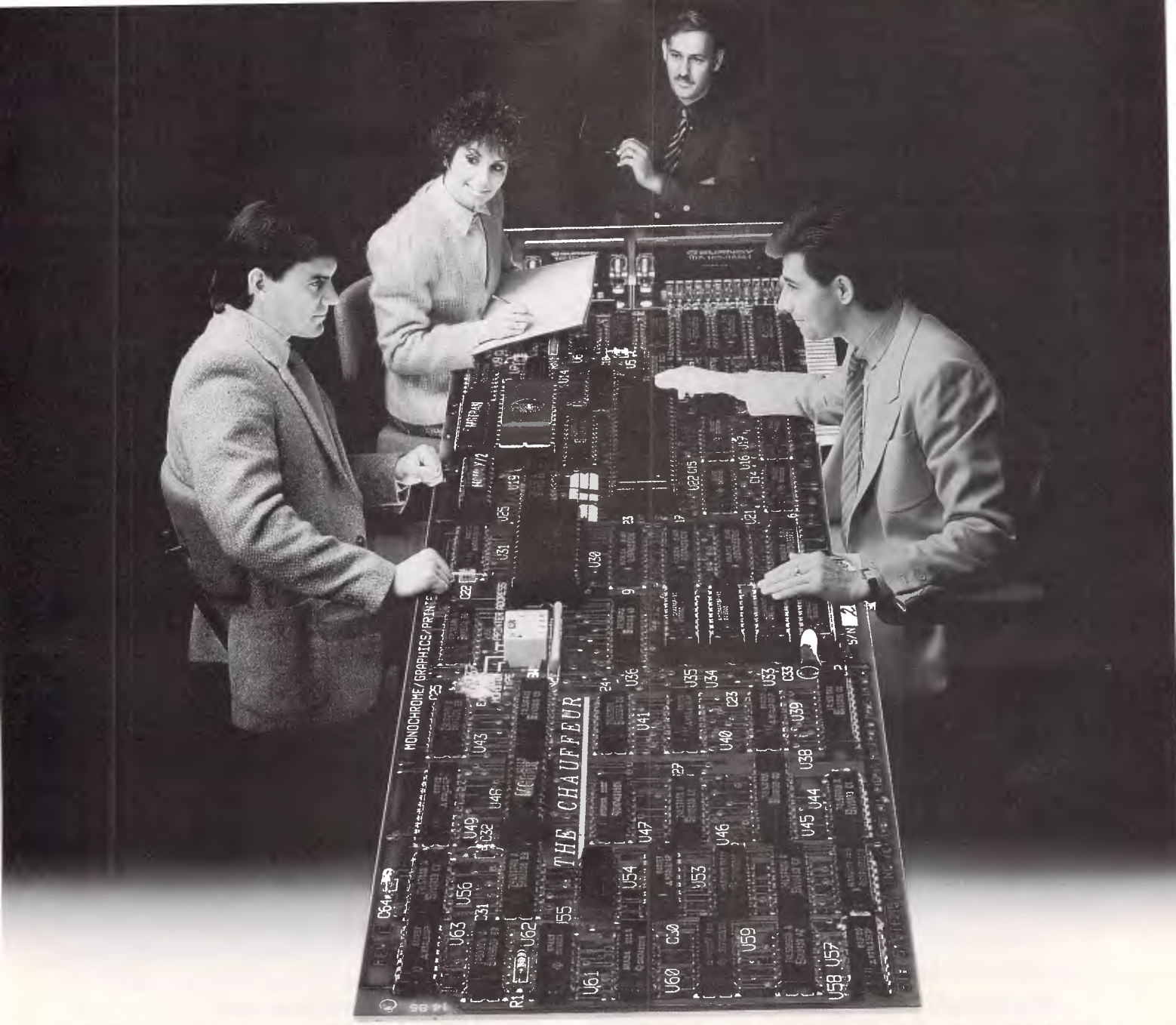
Courses last for one or two days. The price will include refreshments, and get you 'hands on' experience at a keyboard. Course notes will be provided too.

The standard of teaching will vary, as it does in any school. It all depends on the teacher you have.

The standard of teaching will vary, as it does in any school. It all depends on the teacher you have.

The best are those who have a background in training and knowledge of computers. They come from all sorts of careers, to teach full or part time. Some have been DP managers, and responsible for training their staff. Others have been professional teachers, and learnt about computers.

Teaching skills are ultimately more important than computer knowledge. Any fool can be taught how to use a word processor — not everybody has a knack of imparting that knowledge to others. Unfortunately, unless you hear by word of mouth, there is little way of telling if your tutor will be good or not until you turn up for the course.



Expanding your IBM PC may be a board decision

STB provides a solution to the widest variety of board decisions.

STB's Chauffeur is the ultimate monochrome video adaptor board which converts any IBM color graphics display into a format compatible with IBM and ROLAND monochrome monitors. It converts all IBM color graphics on the monochrome screen to a 16 level grey scale. Color graphics displays are shown in full screen format eliminating the need for software modifications, pre-boot software or drivers. A parallel printer port is included as a standard feature.

STB's Graphics Plus II is a universal video adaptor for the IBM Personal Computer range that runs RGB color and IBM monochrome monitors. Graphics Plus II provides 4 and 16 color modes as well as full screen monochrome graphics, using the software drivers provided. Both STB's Chauffeur and Graphics Plus II, provide clear sharp text and graphics on a monochrome screen, free of flickering and fuzzy images. Both include PC Accelerator software, giving printer buffering, high speed disk emulation and hi-resolution drivers for Lotus 1-2-3, Symphony and Framework.

STB's Super Res 400, offers the very best in RGB intricate color graphics for IBM PC, XT and AT. It is designed for use with RGB Monitors such as Roland's CD 240, which have a scan rate of 25 KHz, and 400 line resolution.

STB's Rio Plus II and Rio Grande provide all your additional memory and communications needs.

Contact Roland DG for the name of your nearest dealer who will provide full technical information and a product demonstration.

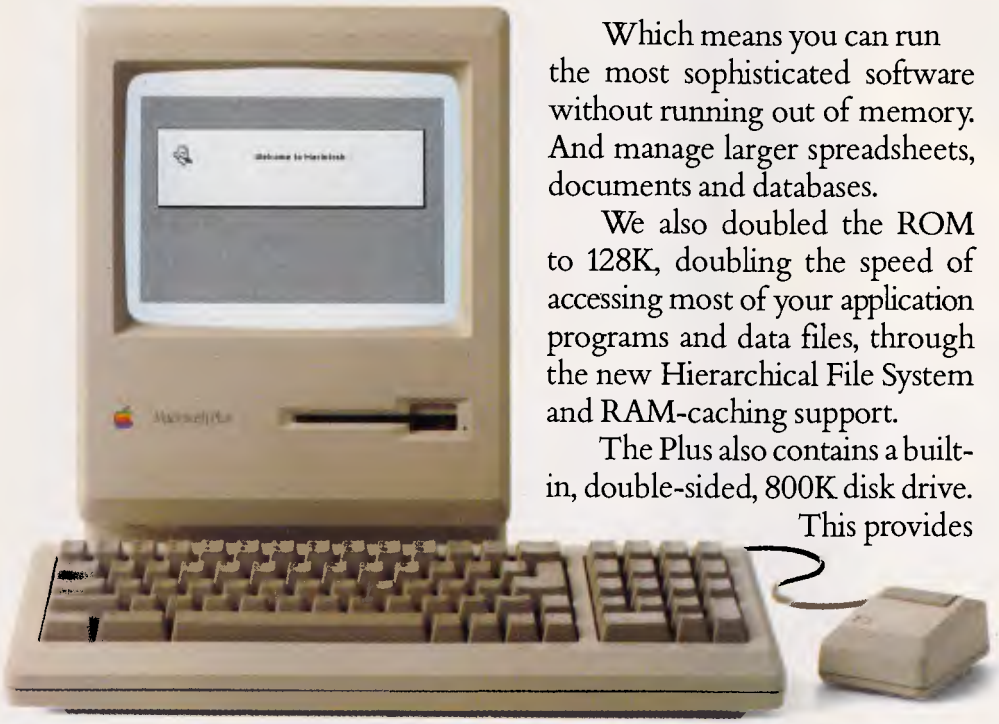
Roland Corporation Australia Pty. Ltd.
50 Garden Street
South Yarra Victoria 3141
Telephone (03) 241 1254
Facsimile (03) 241 1257
23 Cross Street
Brookvale N.S.W. 2100
Telephone (02) 938 3911
Telex 27769

Roland DG New Zealand
1 Ngaire Avenue
Epsom Auckland.
PO. Box 36-045
Telephone (9) 50 4046
Telex N.Z. (74) 60555

Roland DG

ROL C23/S FPS

New Macintosh Plus. We've added



This year Apple introduces a new Macintosh.

Macintosh Plus.

As the name suggests, it's evolutionary, rather than revolutionary

(It's not our policy to bring out totally new computers for the sake of it. Instead we strive to perfect existing ones.)

Macintosh Plus is as simple to learn and use as before.

But there are some big differences, encouraged, we don't mind admitting, by current Macintosh owners.

Some of you asked for more power, others speed. Some needed greater storage capacity, others expandability.

Some heavy number-crunchers wanted a numeric key pad and conventional cursor keys built into the keyboard rather than remote.

Done. Done. And done.

The pluses of this new Macintosh include a full megabyte of RAM (expandable to four megabytes).

Which means you can run the most sophisticated software without running out of memory. And manage larger spreadsheets, documents and databases.

We also doubled the ROM to 128K, doubling the speed of accessing most of your application programs and data files, through the new Hierarchical File System and RAM-caching support.

The Plus also contains a built-in, double-sided, 800K disk drive. This provides twice the capacity of the previous Macintosh and the equivalent of 400 typed pages, or a bulging file drawer.

If that's still not enough, you can always plug in another 800K external drive.

Or you can really go all out and add our new Hard Disk 20.

(Its 20 megabytes are about 10,000 pages worth.)

Just plug in a Macintosh Hard Disk 20 and you can keep all your software, files, worksheets and documents within a moment's notice of your screen.

Add the Apple program Switcher, and you can actually work with several applications at once, moving information from one into another with the greatest of ease.

So you can transfer notes from an outline to a report – or numbers from a data file to a spreadsheet – as fast as you can click your mouse.

AppleCare.

All Apple products come with an automatic 3-month warranty covering all parts and labour.

But this year, Apple introduced a sort of "Warranty Plus" through the AppleCare service programme.

If you fill out and mail to us the registration form enclosed with your equipment, you will receive nine extra months' cover on top of the normal three.

Macintosh Plus also features a new SCSI connection port (dubbed "Scuzzy" in typical fashion by the development team).

SCSI stands for Small Computer Systems Interface and it's an industry standard.

We've virtually opened up the architecture. But what we've really done, of course, is open up a whole new world of possibilities.

The Scuzzy port let's you daisy-chain up to seven high-performance (and often low-priced) peripherals like hard disks, file servers and tape backups from all sorts of third parties.

Given all this power, it made sense to team it with equally impressive printers.

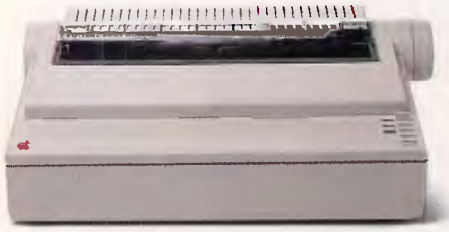
The new LaserWriter Plus is just such, producing documents with text and graphics of publishing quality.

everything except complications.

And it maintains this fidelity on copy paper, letterhead, labels, envelopes or overhead transparencies.

LaserWriter Plus has 35 different typefaces built in, a choice that would embarrass your local printer (and his invoices).

But if you don't need publication-quality printing, you can have near letter-quality by teaming up your Macintosh with the ImageWriter II.



It prints in three different modes: high-quality, standard and draft. And churns it out at speeds of up to 2½ pages per minute.

You can feed in single sheets automatically with the optional SheetFeeder.

And print up to seven colours using appropriate software.

ImageWriter II can also be shared with other Macintosh users via AppleTalk.

But this Macintosh isn't called Plus for nothing. You can just add and add.

Items like an AppleTalk Personal Network.

It's the most flexible, low-cost, easy-to-set-up, easy-to-use network around.

It'll connect up an office full of Macintoshes, LaserWriters, ImageWriters and file and disk servers – 32 devices in all.

Using an electronic mail package, you can send messages to any Macintosh screen on the network.

Or with EtherMac software you can share information with other computers. (Our computer is so friendly it'll even talk to IBMs.)

Add an Apple Modem 1200 to your Macintosh and you can talk to anyone virtually anywhere.

With a communications program like MacTerminal, a standard telephone and an Apple modem, your Macintosh can plug into electronic information services like Viatel, Minerva and Midas and communicate with mainframes and minicomputers.

If you already own a Macintosh, there's another plus.

You can upgrade your machine to the new one megabyte. Ask your dealer for upgrade details.

You can also upgrade your LaserWriter to become a LaserWriter Plus.

Get hands-on with the new Macintosh Plus.

You should like it.

You helped design it.

The Apple business card.

If you wish to own a Macintosh system, you can take advantage of the Apple Credit Card, available from participating dealers.

You can use it to purchase computers, peripheral equipment and software with no down-payment and less impact on your cash flow.

If you qualify, in most cases you can take your own Macintosh with you and dive straight into work with it the same day.

For an authorised Apple dealer near you outside Sydney, you call toll-free (008) 22 1555 or Sydney 908 9088. AP 219/Palace

Apple

It is therefore worth finding out the background of the tutor before taking the course you want to do. There are some who are world class in their approach. Equally there are the rogues who speak at you, rather than try and teach.

The next thing to find out is the size of the class and how many students there are per computer. A large class is a disadvantage, as there is little time for personal attention. Ten to 15 students per class is an ideal size.

If you have to share a keyboard, that is a disadvantage. When you are wanting plenty of 'hands on' experience, having to stop and let somebody else do an exercise is frustrating and boring. With sessions that are more theory than practice, two per computer is acceptable.

... you might easily find yourself in a course that is pitched at the wrong level, has a poor tutor and no course notes.

Companies that run a large number of courses will usually have no trouble in pitching courses at beginners, intermediate and advanced levels. It is important that you get on a course that is relevant to your level of experience. If not, you'll be wasting time or out of your depth.

That's why you should be offered a choice of advanced or introductory courses. Find out what sort of experience is needed for the advanced course. Some introductory courses can be very, very introductory.

Smaller companies that run very few courses may throw a wide range of students in together, with little regard for comparative experience. If the numbers are down and the courses frequent, that is a good sign.

Each tutor has a distinctive way of training. Usually a training company simply gives them a list of material that must be covered, and they do it in their own way, albeit with the approval of their employer. If you find a good tutor, spread the word.

What the course prospectus details can be informative. Some courses cover a great deal of ground in a very short time. That's fine if you are a fast learner, but not so good if you get stuck at the beginning. So, go for a course that covers about as much as you think you can comfortably absorb in the hours allotted.

If a course seems a bit thin on the subject matter, find out why. The tutor's style may be to give plenty of time for

Where, when, how much?

ACI Computer Services runs a wide range of courses at 12 full time and other occasional training rooms around Australia. Courses are held over periods from half a day to a week, with some after hours tuition available. Some 20 micro-related subjects are covered, including Displaywrite, popular software packages and local area networking. Class sizes average seven students, each with a PC, and the PCs are networked together so they can be controlled by the instructor. Prices start at $85. (03) 543 6166.

ASI Advanced Systems Australasia sells and hires thousands of multi-media courses, on video, disk and laserdisk. (02) 698 4999.

Astro Educational Services runs a four day, one hour per day course on Appleworks. Classes are from eight to 16 students and the cost is $40. (03) 232 4000.

Australian College For Micro-computers offers general and software specific courses in small classes, with each student at a micro. Courses are daytime or evening, and cost from $20 an hour. (02) 74 9870.

Australian Personal Computer Corporation specialises in customising courses for specific markets. It runs a range of 12 micro-related courses, with five to ten students per course, each on a PC. The cost is $200 per person per day. (03) 329 8477.

Blakehurst Computer College is shortly to commence a series of courses starting with an introduction for beginners and moving on to accounting, Lotus 1-2-3 and integrated packages. (02) 546 7502.

Chalmers Computer Centre has courses in various business packages, covering wordprocessing, database, spreadsheet and Displaywrite applications. (03) 654 4099.

Computerland courses vary from store to store, with stores in all mainland capital cities. One even offers interactive video courses on MS-DOS and Lotus. All offer trainer led courses on a wide variety of subjects, using the internationally recognized Computerprep courseware. Classes are limited to 10 people, and a two day course costs $395. (02) 451 8899.

Confratel Computer Services provides on-site training to clients in Sydney and Melbourne, using the customer's hardware and facilities. Courses are designed in consultation with the client. They are best suited to small groups, and costs are negotiable. (03) 62 4515.

Deloitte Haskins & Sells runs nationwide courses on a range of 15 subjects. They are one or two day, with a maximum of six students per class. A two day course costs $390. (02) 250 0413.

Deltak is a leading supplier of multi-media, computer-based and video training courses, with over 500 for micros. (03) 699 5611.

Development Systems International is more mainframe orientated, but does run courses on word-processing, Basic and operating systems. The courses are run day or evening, and cost from $5 to $10 per hour. (03) 63 1175.

Drake Computer Systems, with offices in Sydney, Canberra and Melbourne, has about 13 courses for micros on popular business software. There is post-training back-up available, and if there are 12 students in a class, a second instructor will assist. Costs are $190 per student per day. (03) 699 2400.

Hales Commercial College offers courses over a day, a weekend or longer. It has three full time courses approved by the Victorian Education Department. Shorter courses cover popular software packages, on demand. They cost $100 per day. The one or two year course costs $1,200. (03) 63 1181.

Management Technology Education Centre is one of the largest training organizations in Australia, with offices in Sydney and Melbourne. It runs some 20 micro courses per month, plus frequent seminars on a variety of subjects. Costs are $395 for a two day introductory course, $435 for two day advanced courses. (02) 290 3555.

Metropolitan Computer College runs 13 different micro courses, and a diploma course in programming. The courses are daytime, and from one to three days. The costs are $195 per day. (02) 232 7666.

Paxus Consulting is upgrading its training facilities dramatically. It runs about 20 courses a month on Lotus, Dataflex, WordStar and other PC packages. A two day course costs $395. (03) 62 7521.

Practical Software offers courses in Lotus, Symphony, dBaseIII and Dataflex. Courses are restricted to eight per class, one person per micro, and there are three courses per week. A two day course costs $350. (03) 267 4844.

Tandy Computer Centres run courses through their nationwide chain of stores on Lotus, dBase and wordprocessing, These three day courses cost $225. There are also $100 courses introducing Basic and the Tandy PC. All courses are run on Tandy hardware. (03) 553 3299.

For other training centres, contact your dealer or look in the Yellow Pages.

Graphics Expander™

Volume 1

Program Features:

Over 300 Wonderful New Graphics

Graphics Expander Volume 1 offers you a marvelous assortment of graphics that are packed with personality. Some are humorous, some are serious, but all of them are *extremely useful.*

There are *dozens* of categories. You'll easily be able to find just the right graphic for the right occasion. Personalize your banners, cards, signs and letterhead in a variety of fabulous new ways.

Powerful Drawing and Editing Tools

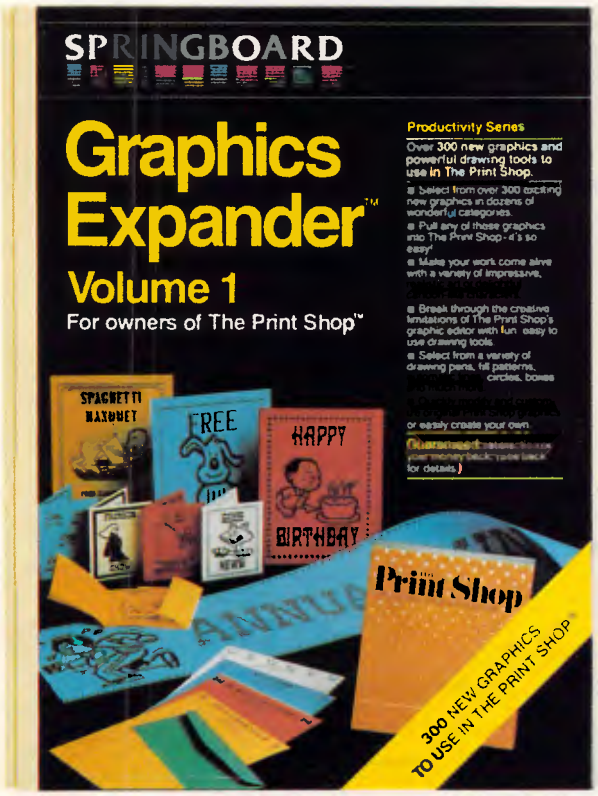
Now it's *fun and easy* to edit any graphic and customize your work. Choose one of our Graphics Expander graphics, a Print Shop graphic, any hi res graphic or draw your own original art. Then use the Graphics Expander drawing and editing tools to:

- Flip graphics from left to right
- Draw automatic lines, boxes and circles
- Modify with fun drawing pens and fill patterns
- Magnify for quick and easy detail editing
- Add text in a variety of sizes and typestyles as captions for your graphics
- Use the OOPS to easily correct any mistake

Turn Hi Res Pictures Into Usable Graphics For The Print Shop

The number of graphics possibilities for use in The Print Shop just became unlimited. The Graphics Expander will convert your favorite hi res pictures from sources like the Koala Pad or a digitizer into graphics for The Print Shop.

SPRINGBOARD™



Graphics Expander™

Volume 1

For owners of The Print Shop™

Over 300 exciting new graphics and powerful drawing and editing tools to use in The Print Shop.

Owners of The Print Shop won't want to miss this! Introducing the Graphics Expander. The Graphics Expander is an add-on product to The Print Shop that dramatically expands the scope of its creative possibilities. Now, you can make your banners, signs, cards and letterhead look better than ever.

What does The Graphics Expander include?

1. Over 300 wonderful new graphics to use in Print Shop banners, cards, signs and letterhead.
2. Fun and easy to use drawing and editing tools that let you combine and modify graphics or create your own. Even add text for a personal touch. You now have complete control over graphics from The Print Shop, The Print Shop Graphics Library and The Graphics Expander.
3. The ability to capture graphics from other sources (like the Koala Pad™ or a digitizer) for use in The Print Shop.
4. The ability to automatically save your creations and pull them into The Print Shop quickly and easily.

Suggested Retail: $54.95
Available For: Apple *II+*, *IIe*, *IIc* - Disk
Requirements: 64K

Available from your local software supplier
Distributed exclusively in Australia by:

dataflow Computer Services Pty. Ltd.
134 Barcom Ave, RUSHCUTTERS BAY 2011 Ph: (02) 331 6153

'hands on' experience, or to allow questions. Some advanced courses are often little more than questions from the floor, with the tutor using student problems to illustrate points. Learning from mistakes can be rewarding.

At the end of the course, you should be presented with course notes. These can vary from a couple of photocopied sheets to copious notes and help sheets that you will use for many years to come. You should be able to examine these before signing up for a course. The better the notes, the better the course.

Follow these guidelines, ask the right questions and you should be able to find a course to match your requirements. There are many available, and a day or so spent training will repay itself time and time again.

If you are more serious about your computer, to the extent of wanting to make a career out of it, there are numerous full and part time courses available.

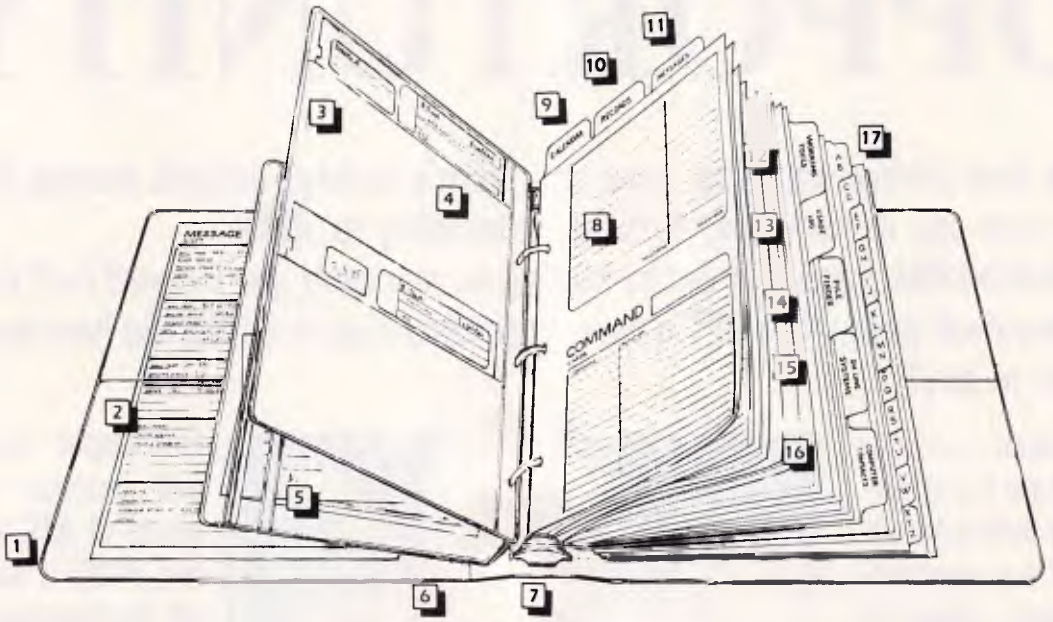
Most universities and technical colleges run three or four year computer science courses. Last year, some 1,865 students graduated with degrees in computer science. These courses are not easy and the demand for places is very high, though jobs at the end are all but guaranteed.

The tertiary institutions with most places for computer science students are Adelaide University, Melbourne University, Monash, Chisholm, University of New South Wales, University of Sydney, Queensland University, and the Institutes of Technology in NSW, Queensland, Melbourne and Western Australia.

For those who can't afford to take four years away from employment, companies such as the Control Data Institute offer intensive six month courses that prepare students for jobs as programmers. These courses are quite expensive, but they do give valuable experience and if you persevere, will see you in the DP industry as a full time professional. You'll need commitment, you'll need cash, and you'll get results.

END

The Latest in Computer Hardware



The Complete Computer Management System

Finally, a system to organize the use of your personal computer and greatly increase your productivity! THE COMPUTER COMPANION replaces loose notes, slips of paper, and memorization with well-organized forms stored in a high quality, three-ring vinyl binder. It puts the miscellaneous items you use with your computer in one place, in one package. Saves much time and aggravation.

1 **Beautiful, Durable Cover**
Available in black leather look PVC

2 **Convenient Pockets**
A place for loose papers, brochures, notes, etc.

3 **Diskette Storage Pouches**
Stores up to four diskettes with the appropriate custom command card

4 **Custom Diskette Labels**
Preprinted labels to help you sort data

5 **Ziplock Pouch**
Secure storage of warranty cards, contracts and receipts

6 **Grid-Flex Hinge** (Patent Pending)
Guaranteed not to crack

7 **Quality Double Booster Rings**
1¼" size accepts all standard 5½ x 8½ refills

8 **Custom Command Cards**
Create your own software command cards that tear out and work next to your computer

9 **Weekly Updated Calendar**
26 weeks of appointments and events

10 **Records**
Maintenance Log — A weekly checklist for cleaning and servicing your computer.
Hardware Data and Report Log — Organizes important information for each of your components
Software Data and Support Log — Keeps track of information like support contacts, sales rep. data, patches and modifications, updates and support histories, and much more.
Insurance Information — Vital information, neatly organised

11 **Messages**
Perfect for phone and electronic mail messages

12 **Working Tools**
Flowchart and Display Worksheets — Grid sheets to flow chart your programs and for designing spread sheet models, reports and forms

13 **Usage Log**
Keeps track of business and personal use of your computer — for tax deductions or corporate budgeting

14 **File Finder**
A chronological organizer to help you pin-point files and clean up cluttered disks

15 **Online Services**
Online Services — Keeps track of access codes, passwords, protocols, commands and other important information
Database Search Planner — To guide and speed your searches through online databases like CompuServe or The Knowledge Index
Bulletin Board Systems — Similar to "Online Services" — organizes the vital information for using your favorite electronic bulletin boards.
User Group Directory — Meeting times and places, library location, important members and more

16 **Computer Contacts**
Computer ID and Phone Book — Keeps track of your contact's name, address, online service ID and or computer phone number

17 **A-Z Index**
Organizes alphabetically "Computer Contacts," "On Line Services," "Bulletin Board Systems," "Software Data Sheets," and more

Don't miss out order your computer companion now

PHONE ORDERS & SPECIAL REQUIREMENTS PLEASE PHONE:
MELBOURNE: (03) 645 1888 — SYDNEY: (02) 698 5525 — ELSEWHERE: (008) 33 1133 (This is a toll free number)

Yes, I want to keep all computer "essentials" where I need them, when I need them.

Colour	Colour Code	Price	Qty.	Total $
Black	10	59.00		

ITEMS	4-14	15-39	40-99	100-over	Less Quantity Discount (if applicable)
LESS	10%	15%	20%	25%	

Need your computer companion in a hurry. Take advantage of our **FLASH DELIVERY**. Guaranteed delivery to any Australian capital city within 48 hours. $8.00 per item (if required)

Add $3.50 for handling & delivery

Total enclosed $

Interstate deliveries made by Ansett Freight Express
Please deliver my order to: (sorry no P.O. Box Numbers)

Name _____

Address _____

_____ Postcode _____

Telephone Number _____

☐ Please find my cheque enclosed ☐ Please charge my Credit Card
☐ Bankcard ☐ American Express ☐ Visa ☐ Mastercard

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Signature _____ Expiry Date _____

Can't find a stamp: Simply address your envelope to:
FREEPOST AAA350
Debden Diaries
57 Rouse St.,
Port Melbourne,
Victoria, 3207
Australia

Office Use Only

Date Received

Record Number

Offer closes March 28

INVESTMENT OPPORTUNITY

Why leave your savings moulding away in a bank's savings account earning 8% or 9% when you can cop a staggering 47% by subscribing to **APC?**

Sounds incredible, doesn't it! But by sending us your cash, you'll save $7 off the next 12 month's newstand price when **APC**'s cover price shoots up to $3.50. So how much would you expect to pay?

Don't answer —'cause we'll also throw in a super-sturdy binder built to handle the stress of accommodating a full year's issues of **APC**. The binder alone normally sells for $9.50.

Now, how much would you expect to pay for 12 months of **APC** at an annual saving of $7 and a free blue binder with **APC** logo emblazened across the front?

Don't answer yet, because we'll even throw in free postage and wrapping. So, how much would you expect to invest. Remember, you get 12 issues of Australia's top-selling computer magazine; a sturdy blue binder; free wrapping and postage for all 12 issues of **APC** and the binder; **PLUS** a saving of $7 off the newstand price. All this would normally cost $51.50.

Would you pay $45? What about $42? Of course you would! Well, how about $39.99? But our price is only $35!

That's right — send only $35. And that's a return of 46% on your money. Hey, hey — this sounds too good to be true. But it is (true)! **AND**, because of the way our accountants will structure your investment, you won't pay one cent in tax.

SUBSCRIPTION ORDER FORM

I would like to subscribe to *APC* and receive a free binder
☐ This is a new subscription ☐ This is a renewal

☐ 1 year *(12 issues)* Aust. $35 ☐ 2 years *(24 issues)* Aust. $65
☐ 1 year rest of the world *(12 issues)* Aust. $60 surface mail ☐ 3 years *(36 issues)* Aust. $90

☐ I enclose my cheque, made payable to *Australian Personal Computer* for $ _____
☐ Please debit my American Express/Bank Card/Visa *(delete where not applicable).*

Account No: _____ Expiry Date: _____ Signed: _____ Name: _____
Address: _____ Post code _____

COMPUTERS LEARN TO SPEAK POLAROID®

Computers that speak Polaroid have an advantage. They can produce computer generated graphics as slides and prints, instantly. Which is like carrying your computer screen in the palm of your hand.

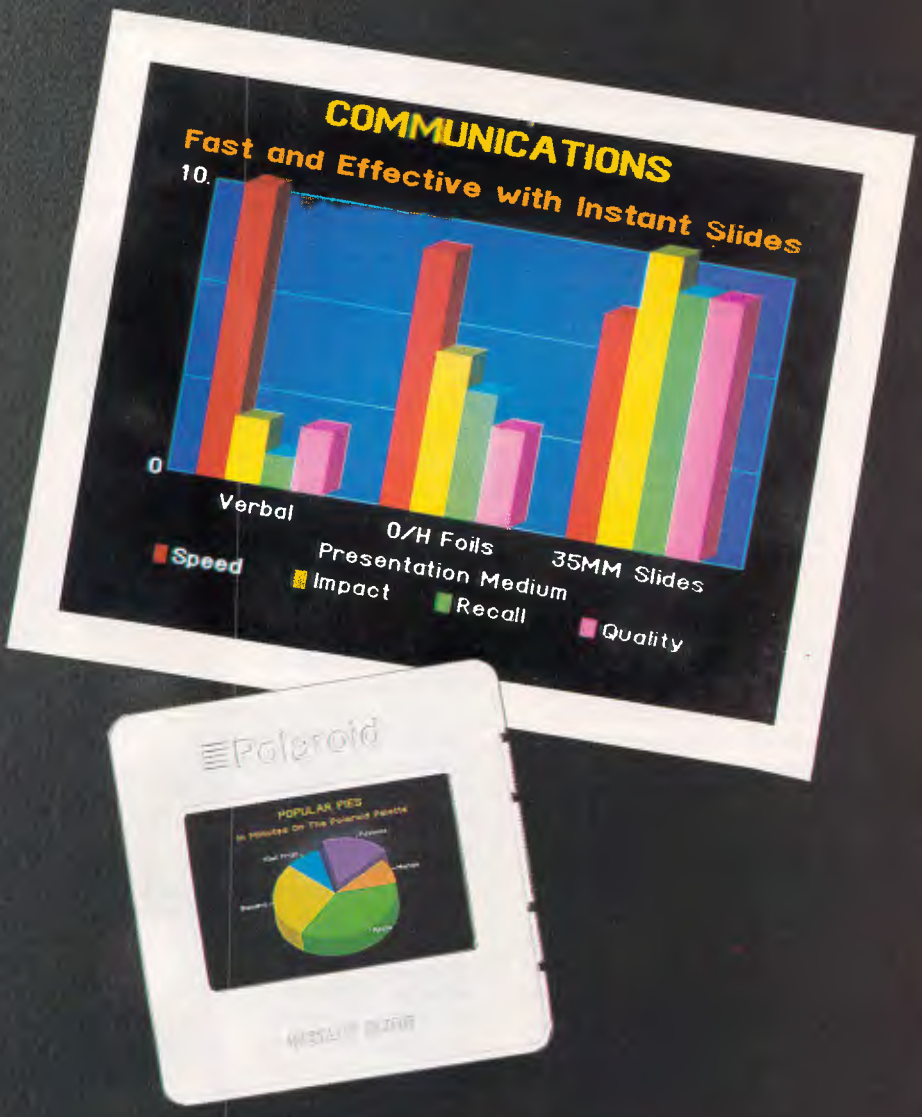
Speak Polaroid and you're speaking visually, so you communicate, fast and effectively. People remember what they see.

Using the Polaroid Palette it's easy to make color slides of your computer generated graphics.

Whole presentations can be organised on the spot and last minute changes are no problem.

Your work remains confidential, no outside services are involved and no outside fees are incurred.

Learn to speak Polaroid and you're at an advantage. For more information call the Polaroid Hotline toll free 008 226 785 or 887 2333 for Sydney metropolitan areas.



Polaroid. The universal computer language.

YANKEE DOODLES

David Ahl talks of Transylvania and Safaris as well as giving details of IBM's new lap-held computers.

Well understood

In the early 80s, like so many other companies, Penguin Software introduced scores of decent games but rarely a big hit. For example, Pie Man was one of the company's best games — but it was no 'megastar'.

However, Penguin struck gold with The Graphics Magician, a creation of Merk Pelzarski and David Lubar: this is a utility package designed to help people create graphics for other programs, especially games. Penguin was smart in its marketing, originally aiming it at other computer games companies and then releasing it to the mass market.

Now Penguin has come up with Comprehend, a utility for producing interactive fiction (adventure games) with Infocom-type parsing and depth in text as well as the graphics for which Penguin is known. Comprehend understands full — and multiple — sentence commands, most parts of speech, and has a vocabulary of over 1000 words. It uses the same efficient graphics-packing techniques as The Graphics Magician, so finished programs can combine a fair amount of both text and graphics.

The first 'illustrated interactive novel' produced with Comprehend is called The Crimson Crown by Antonio Antiochia. In it you can return to Transylvania with Princess Sabrina and Crown Prince Erik in search of the crimson crown which has been stolen by the murderous Vampyr. Comprehend is a portable system and runs on eight major computers, thus The Crimson Crown is also available for eight computers (Apple, Macintosh, Commodore 64 and 128, Atari 800 and 520ST, Amiga and IBM PC).

On safari

AT&T will shortly release an IBM-compatible lap-top computer, dubbed the Safari 7. It has a flip-up, 9½in LCD screen which can, through shading, simulate four colours. It has two 8088 CPU, 256k of memory expandable to 1Mbyte, a 5¼in floppy disk, an optional 10Mbyte hard disk, and weighs in at an arm-stretching 14lbs without batteries.

Not to be left out, IBM will also be introducing two lap-holds during 1986. The basic P-12 uses an 80C88 CPU and has 256k; everything else is an option: LCD or electro-luminescent display, one or two 3½in disk drives, and memory up to 640k. The P-14 is a high-end machine based on an 80286 CPU and will be aimed at vertical markets. The machines will come with DOS 3.1 and a utility called Xcopy, allowing users to swap files between 3½in and 5¼in disks.

Going against the grain of PC-compatible lap-helds, Tandy has added the Model 600 to its line. It has an 80-character x 16-line screen, 32k of RAM (expandable to 224k) and a built-in 3½in disk drive. The Model 600, like its predecessors, has a proprietary operating system and built-in applications, most of which are quite good and easy to use. The word processor is similar to Microsoft Word and the spreadsheet, Plan, is a variation on Microsoft Multiplan. The communications program which works with the self-contained modem is excellent, but the File and Calendar programs are bare bones at best. The machine weighs 12 lbs, costs $US1,600 and will probably sell on the market less well than Tandy would like.

Amiga onslaught

Seven third-party companies are beginning to ship the first wave of software packages for the Commodore Amiga. From Chang Labs comes Rags to Riches, an accounting package (general ledger, accounts receivable and accounts payable) which can handle up to 6000 accounts and up to 10,000 transactions. It costs $US499.

Lattice Software has released seven packages including Unicalc, a spreadsheet that reads Lotus 1-2-3 files ($US79); dBaseIII, a file system that reads dBaseIII files ($US150); a full-screen editor ($US100); and several other utilities for Unix and C programmers.

Island Graphics, an early rider on the Amiga bandwagon, has developed two graphics packages for high-resolution painting and animation ($US140), and for executive presentations ($US200) which are being distributed by Aegis Development Inc. The software takes full advantage of the 640 x 200 pixel resolution of the Amiga and allows 32 colours (from a palette of 4096) to be displayed simultaneously.

Maxisoft has developed two multi-tasking packages: MaxiComm, a communications package ($US50) and MaxiDesk, a desk-top utility with a telephone directory, notepad, calculator, dialler, alarm clock and appointment calendar ($US70).

Through its own channels, Commodore is marketing Chang Labs' Rags to Riches and several other third-party packages including Arktronic's Textcraft word processor ($US100); Metacomco's Pascal ($US100), Lisp ($US200) and assembler ($US100); Island Graphics' Graphicraft ($US50); and Lattice's C language.

Commodore has stated that over 900 developers have received Amiga development units so far, and that 150 additional software packages are expected to be launched early this year.

Random bits

Atari is expected to release a 1Mbyte version of the ST in early 1986, probably in Germany . . . Votrax has introduced the Votalker for the IBM PC and Apple II computers which enable the computer to talk or sing with 32 inflections, a five-octave range and 16 amplitudes. However, it still has a mild but unmistakable Swedish accent . . . AST has announced its first Apple II products: a 20Mbytes hard disk/tape back-up system, an I/O multifunction card, MegaRam-Plus (RAM, cache and 80-column card), and three other boards . . . Lifetree Software has upgraded its Volkswriter word processing package with a 170,000-word spelling checker, hyphenation and a four-function calculator. Volkswriter 3 costs $US295; upgrades from earlier versions cost $US95 . . . Microsoft has released Macro Assembler 4, an upgraded version with the ability to assemble larger source files with more symbols and more macro text, and the ability to support the newer Intel 80186, 80286 and 80287 instruction sets ($US150) . . . Paladin has released Super Crunch for the Macintosh. This is the first spreadsheet that talks back to you, as it includes a speech output feature designed as a proof-reading aid.

END

The Perfect Match

Your hardware and Perfect software

Now available for the IBM P.C. and the Apple IIe/IIc

PERFECT WRITER
$395.
"Pop Up" Command Menus.
Lesson Disks included.
Process larger Text Files than your computer's memory.
Handle up to 7 documents simultaneously.
2 Window Display.
Perfect Speller
Perfect Thesaurus

PERFECT FILER
$325.
Full Mail Merge/Sort Capacity with Perfect Writer
16 Ready to use Data Base Forms
Unlimited record storage.
"Pop Up" Command Menus.
On system Help Screens.

PERFECT PACK
$595.

PERFECT CALC
$325.
"Pop Up" Command Menus.
Have up to 15 different Spread Sheets in memory at one time.
On System Help Screens.
Share Data with other spread sheets.
Lesson Disc included.
2 Window Display.

PERFECT LINK
$189.
X — Modem Protocol.
Standard ASCII Data Encoding Structure.
"Pop Up" Command Menus.
Wireless Disk File Transfer.

PERFECT LIBRARY $795.

IBM PCXT supplied by courtesy of IBM and Parity Computer Ltd.

Perfect has a complete summary of Perfect Writer, Filer and Calc which comes in a concise, easy to read booklet complete with two disks entitled the Perfect II Sampler Kit. You can practice entering data on your own P.C. before buying any software. See how easy Perfect Software is to use and just how much it can do for you.

Perfect™

To: **Perfect Information (Australia) Pty. Ltd.**
P.O. Box 946, Crows Nest NSW 2065
Phone (02) 957 6686 or (02) 92 7777

Please send me the following
☐ More literature on Perfect software ☐ The name of my nearest Perfect dealer
☐ The Perfect II Sampler Kit $9.95
I enclose my cheque for $_____ or please debit my American Express, Diners Club, Visa, Mastercard or Bankcard.

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Card expires _____ Signature _____
Name _____
Address _____
_____ Postcode _____
Phone No. _____

Raise your printing with HP

The HP LaserJet printers are just two of the star performers from the HP family of PC peripherals which are designed to help maximize the potential of your Personal Computer. The LaserJet and LaserJet Plus both offer super fast and quiet operation and incomparable quality at a competitive price.
LaserJet will handle a number of different type styles and sizes all on the one page using optional font cartridges. Plus graphics to create charts, graphs and illustrations. With the LaserJet Plus priced under $7,800* you get improved speed and graphics as well as extra capabilities such as built-in shading and patterns which are perfect for enhancing forms and business documents.

Meet the rest of the family.

HP ThinkJet Printer.

A low cost, high quality text and graphics printer that produces professional and easy to read documents. Perfect for company memos. ThinkJet is extremely quiet and offers a variety of printer interfaces plus an adjustable paper feed mechanism.

HP Portable Plus.

In 1985 the predecessor to Portable Plus won the prestigious "Your Computer" magazine PC of the Year. The Portable Plus now gives you the power of a desktop computer and the convenience of a portable specifically designed to lead as busy a life as you do. It is remarkably durable and offers all round flexibility that can

LBV 7776 HEP L

standard in seconds flat LaserJet.

stand alone or perfectly complement your current Personal Computer.

*Recommended retail price includes tax and is subject to change without notice.

To receive your free Information Kit or to learn more about these products through a Hewlett-Packard Authorized Dealer just fill in the coupon below or call HP direct.

Please send me a free information kit on:
☐ LaserJet Printer Family ☐ ThinkJet Printer ☐ Portable Plus
☐ Please arrange for an Authorized Hewlett-Packard Dealer to contact me to discuss these products further.

Name_____ Company_____

Address_____ Postcode_____

Mail to:
ATTENTION
Christene Okey
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
BLACKBURN, VIC. 3130

HEWLETT PACKARD

Melbourne (03) 895 2895 ext. 2902 Canberra (062) 80 4244 Perth (09) 383 2188
Sydney (02) 888 4444 ext. 4711 Adelaide (08) 272 5911 Brisbane (07) 300 4133

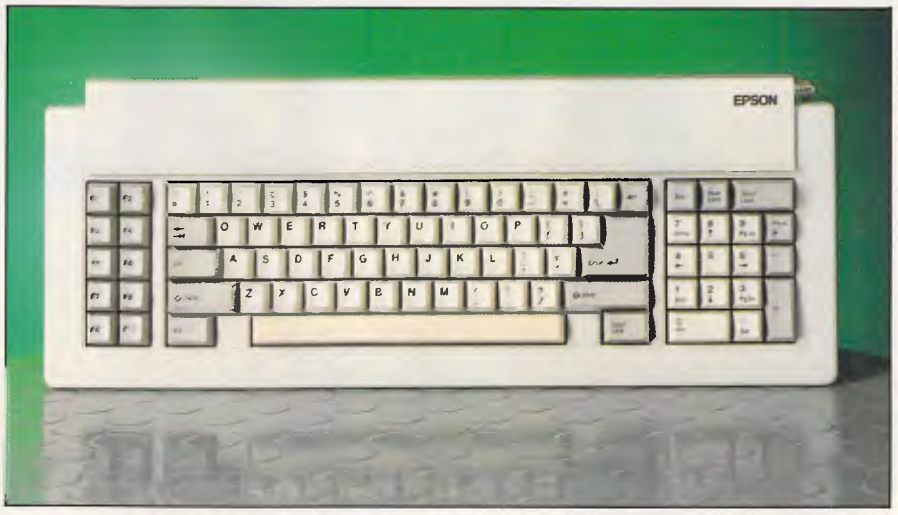
LBV 7776 HEP R/2

Epson PC

Is there room 'on top' for just one more PC clone? Epson's latest micro boasts an attractive design but its price tag may cause it problems. Peter Bright reports.

The last Epson product to face the rigors of an *APC* benchtest was the QX-16; a well-made, but ultimately boring, 16-bit desk-top micro.

Now Epson is at it again. This time it is offering an extremely good-looking IBM PC-compatible, desk-top micro which it hopes to sell in large numbers at a moderate price.



The layout is good but there are no LEDS to show when keys are engaged

Hardware

At first sight the new Epson PC doesn't look like an IBM PC clone at all: it's too well designed. First off, it looks much smaller than an IBM PC. The main unit measures just 365mm wide by 376mm deep by 145mm high. The majority of the casings are made of high-quality plastic finished in a creamy beige colour. The most striking feature of the main unit is the extensive use of ribbing and the profusion of straps and pull-down flaps. The overall effect is very pleasing indeed.

The only obvious things the front panel of the PC houses are a couple of 5.25in disk drives and the 'Epson PC' badge. My first problem, when the review machine arrived and I tried to switch it on, was to find the on/off switch. I searched all over the main unit to no avail, and eventually had to admit defeat and read the manual.

It turns out that as well as containing the disk drives and the Epson badge, the front panel of the PC also houses three flip-down flaps. The on/off switch lives behind a flap in the top right-hand corner next to the top disk drive. This flap also has a piece of optic plastic which allows the power on LED to be seen when the flap is closed.

Of the two remaining flaps on the front panel, one houses the keyboard connector socket and the other contains 10 DIP switches and a reset button.

The flap over the keyboard socket is designed to allow the keyboard cable to be dressed so that it exits neatly from the side of the main unit, allowing the flap to remain closed and keeping the unit looking neat and tidy.

The final flap conceals a reset switch and a bank of DIP switches. The reset switch is something that the original IBM PC and most compatibles don't have: it is useful when the Ctrl/Alt/Del software reset doesn't work. The DIP switches are used to get the RAM size, display mode, number of disk drives and to enable or disable the parallel and serial interfaces. Placing the DIP switches on the outside of the machine rather than inside like the IBM is a good idea, and makes it easier to configure the machine.

The rear panel houses most of the usual IBM-compatible equipment. On the left, at the top, there is a fan and sockets for mains in and out. Below this is an RS232 serial port and an IBM-style parallel printer port. To the right there are covers for five expansion slots, although in fact only three can be used (see below). The review machine was supplied with a colour graphics card in one of the slots. This gives both RGB and composite video outputs.

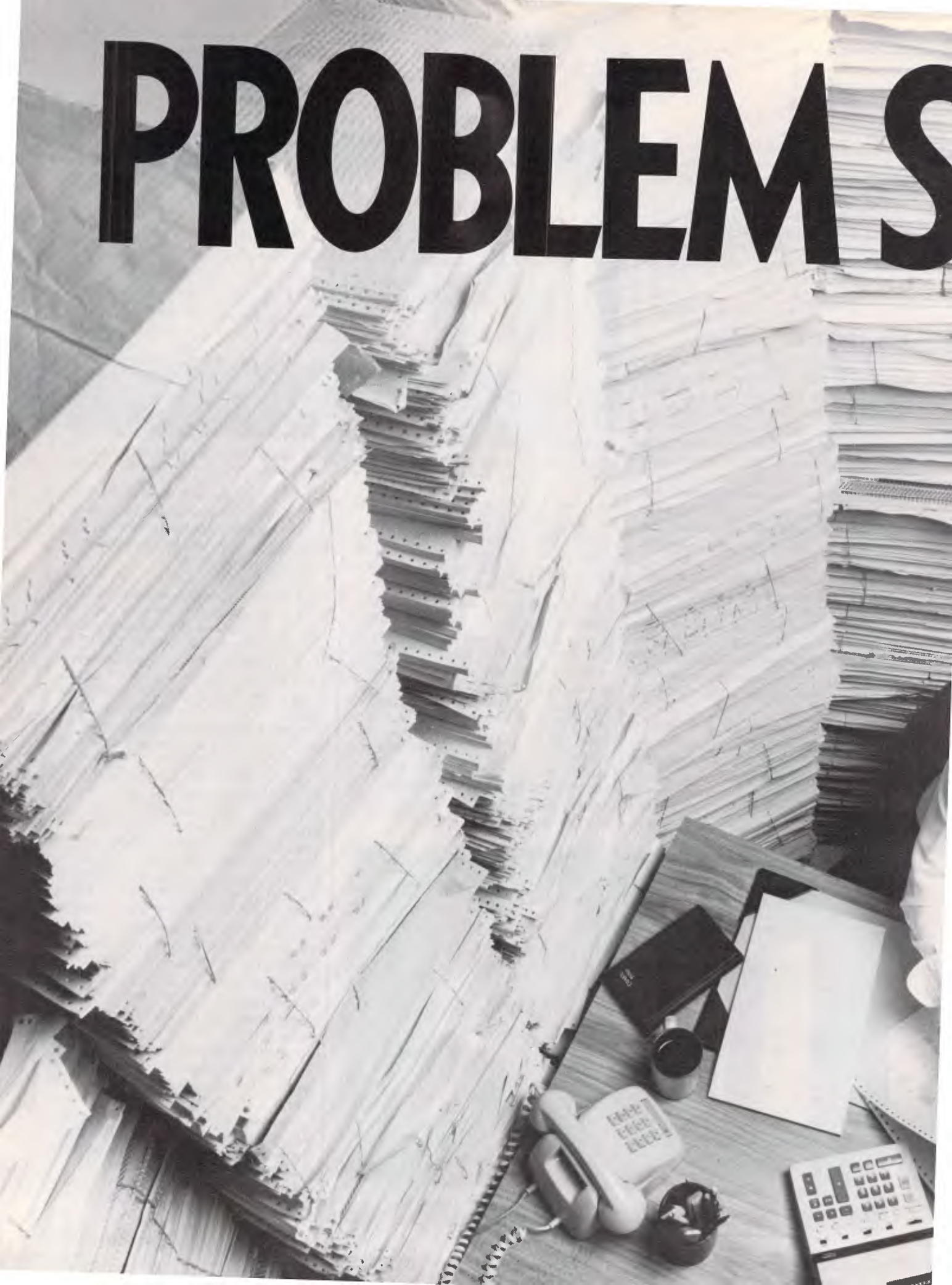
Getting inside the Epson PC is very straightforward once you have figured out where the retaining screws are hiding. To get the lid off, you need to remove a total of seven screws. Five of these are in plain sight and easy to get at. The remaining two are hidden under lever-off covers in the two plastic pillars on the right-hand side of the machine.

Once the screws have been removed, the top cover lifts off to reveal the inner workings of the machine. Most of the rear of the unit is taken up by the power supply module. Unlike most other PC-compatibles, the PSU isn't cased which means that all the high voltage components are exposed. Consequently, you should be much more careful what you touch if you ever take an Epson PC to bits.

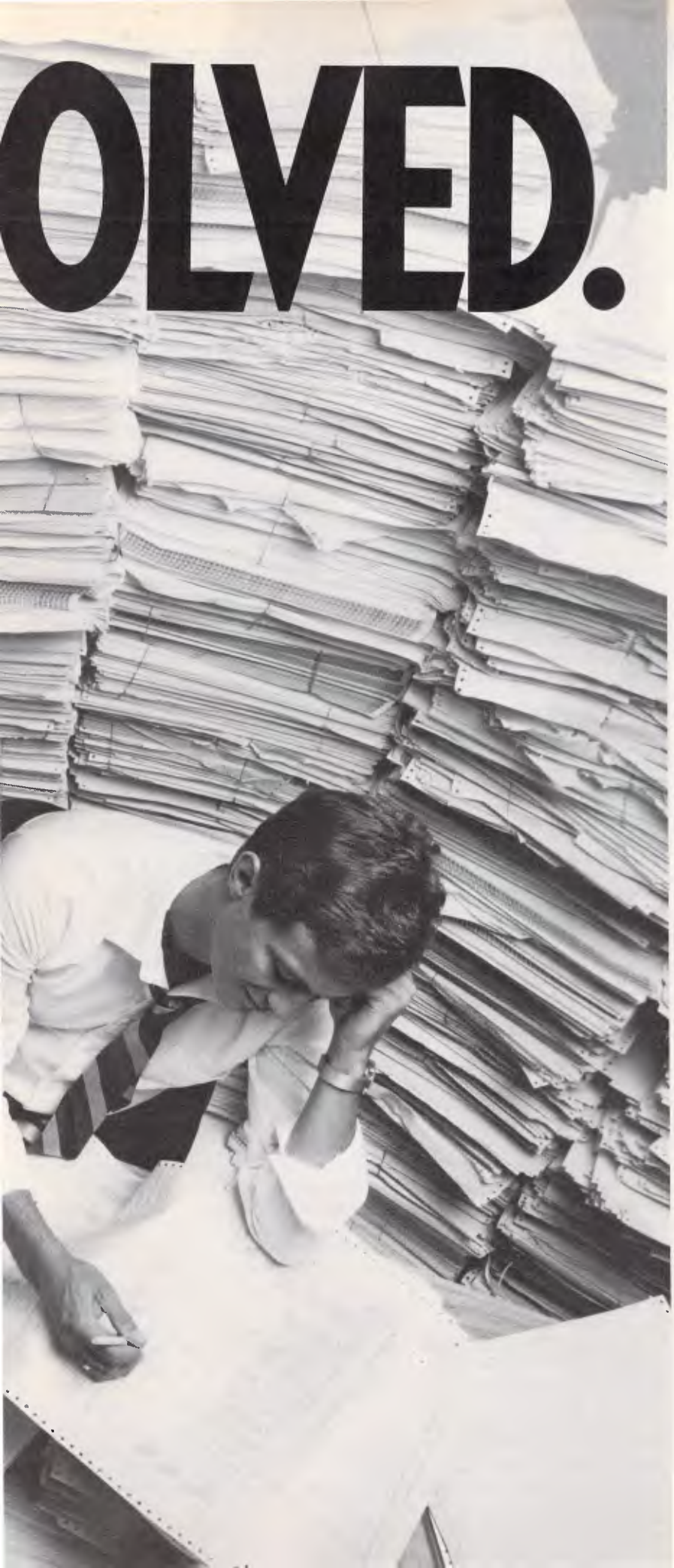
The front of the unit is dominated by a very solid-looking disk drive chassis. The review machine was supplied with two half-height, 5.25in, 360k IBM PC compatible disk drives tacked on top of each other. The PC is also available with a

Epson's BM5 external disk drive unit holds — you guessed it — 5Mbytes

PROBLEMS



OLVED.



PROBLEM: Storage of continuous form computer printouts is eating up valuable space.

Worse yet, to access information from those mountains of forms is a nightmare.

SOLUTION: Canon's new Canofilmer 100-CFF. With it you can microfilm continuous form computer printouts — automatically.

By putting your computer stationery on microfilm you can save up to 96% of your current storage space. All your continuous form computer stationery can now be automatically filmed, filed and forgotten till needed.

And the new Canofilmer 100-CFF is systems compatible. Tri-level blip marking, coupled with 6 digit frame number exposure, makes it the ideal input unit for computer assisted retrieval systems.

The new Canofilmer 100-CFF. Continuous form microfilm filing need no longer be the expensive proposition it once was.

Give Canon a call, or send in the coupon. We'll be glad to show you how Canon Micrographics can solve your continuous form computer printout storage headache or any other document storage problem.

The Canofilmer 100-CFF.

Lawrence Harop Varton/R 145

Name

Company

Address

Postcode

Telephone

Send to Canon Australia Pty. Ltd.
1 Waterloo Road, North Ryde, NSW 2113.

Canon
MICROGRAPHICS

Serviced and distributed by Canon Australia Pty. Ltd. In ***SYDNEY*** *Call Stephen Gardiner. 887 0166,* ***CANBERRA,*** *Peter Kobold. 80 6498,* ***MELBOURNE,*** *Peter Thom. 200 6200.* ***BRISBANE,*** *Brian Hadlow. 44 7436.* ***ADELAIDE,*** *Stewart Harvey. 352 5366,* ***PERTH,*** *Laurie Varendorf. 325 7888, Nick Phillips. 325 2922,* ***HOBART,*** *John Abbott Business Machines. 34 4044.* ***NEWCASTLE,*** *John Sheather. 52 8100.* ***DARWIN,*** *John Sherrington. (089) 84 4200.*

20Mbytes hard disk and one 360k floppy.

The main PCB lies along the bottom of the main unit and is almost entirely obscured by a metal chassis above it. The PCB itself is significantly smaller than that on the IBM PC, even though it incorporates RS232 and Centronics ports where the IBM does not.

The main processor in the Epson PC is listed as an 80C88 running at 4.77MHz. The 80C88 is a slightly enhanced CMOS version of the Intel 8088 used in the IBM PC.

The choice of processor and clock speed is interesting. Most modern IBM PC-compatible machines now use the full-blown, 16-bit 8086 processor rather than the cut-down 8088 used by the IBM PC. Also, most modern compatibles run their processor at 6 or 8MHz rather than the 4.77 of the IBM PC. Epson's decision to use exactly the same processor and clock speed as the IBM PC only marginally helps compatibility, but it does make the Epson PC slow compared to other IBM-compatibles such as the Olivetti M24, which is now available in 10MHz versions.

If you look at the back panel of the machine, you would assume that the Epson PC had five IBM PC-compatible expansion slots, because that's how many blanking plates there are on the panel.

When you get inside the machine, it turns out that while the casing has provision for five cards, the motherboard only has three slots. This is odd, to say the least, and the one area where the Epson PC falls sadly short.

It is also annoying. Although the Epson PC has an RS232 serial port and a Centronics printer port as standard, the display card takes up one slot which only leaves two free for the user. On the review machine, I used one spare slot for an external hard disk drive and the other for my modem card. This used up all the slots and left no room for my AST multi-function card, or any of the other cards that I normally like to use.

On the plus side, the motherboard comes as standard with 512k of RAM, so users needing this much memory will not have to use up another one of the IBM expansion slots.

The Epson PC is available with a monochrome display adaptor or with a colour graphics adaptor. Both units are compatible with the IBM PC. The review machine was supplied with the colour graphics adaptor.

The review machine was also supplied with a very stylish Taxan colour monitor. This was obviously a very expensive unit, but cheaper units would suffice — the IBM display is hardly state-of-the-art in terms of resolution. In use, the display is just like that on the IBM PC. The Epson happily displayed Lotus 1-2-3 graphics and ran Microsoft Flight Simulator.

The most interesting part of the display was not its IBM compatibility, but the Taxan monitor itself. The front panel has thumbwheels for brightness and contrast, and an odd-looking buttom marked with three dots. This button allows you to switch between colour and monochrome display modes. With the switch out, assuming it is receiving a colour signal, the monitor will display in colour. With it in, the monitor will work like a monochrome monitor.

However, unlike normal monochrome monitors, you can select whether you want an amber, green or white display. This is achieved by altering the settings on a bank of DIP switches on the back of the monitor. Using the switches you can also select between normal and reverse sync (very useful that) and set different colour palettes suitable for use with IBM and Apple computers. All in all, this was a very impressive monitor.

Keyboards are a confusing issue with IBM PC-compatible manufacturers at the moment. The problem is should they stick to the IBM PC keyboard layout or should they go with the improved IBM PC/AT layout? The Epson keyboard isn't an exact copy of either unit, but it does owe more than a little to the PC/AT keyboard.

The keyboard unit on the Epson PC connects to the main unit via a fairly short length of coiled cable and a DIN plug. The unit itself is fabricated entirely from

The rear panel houses most of the usual IBM-compatible equipment

The review machine was also supplied with Epson's BM5 external disk drive unit. At this stage Epson has no definite plans to release the BM5 for sale in Australia, but it is included in this test for readers' interest: 5 Mbyte floppy disk drives are not seen everyday. The BM5 is the same depth as the Epson PC, but is slightly higher and about 118mm wide. It is totally self-contained with its own power supply unit, processor board and even its own fan. It connects to a special board in the PC via a hard disk-style parallel interface.

The reason for all this sophistication is that the BM5 is, as mentioned earlier, a 5Mbytes floppy disk drive. Externally, it looks much like any other 5.25in floppy disk drive; even the disks look similar to normal 5.25in disks. The only visible difference is that the disk coating is a slightly darker colour than normal disks, and the sector hole is punched in a different place.

The Epson PC was supplied with a specially patched version of MS-DOS that could access the 5Mbytes floppy. In most respects, it is easier to think of it as a removable hard disk than as a floppy disk drive. It is accessed as drive C, which is usually allocated to hard disks and installation programs as popular applications will happily treat it as a hard disk.

Generally, the BM5 worked well while I was using it. The access times weren't up to hard disk speeds, but then you wouldn't expect them to be. My only trouble occurred when I tried to format a disk. The drive will only read the special ultra-high-density disks which it was designed for, but even so I ended up with 26k of bad sectors when I formatted the disk. I suppose 26k out of five megabytes is acceptable when you consider the close tolerance involved in this kind of high-density drive, but I still found the idea of all those bad sectors disconcerting.

The main problem with the BM5 is its pricing. Where Epson is selling the BM5, elsewhere in the world, it has pitched the 5Mbytes floppy at just under the entry level Epson PC, which is strange. Epson thinks that the BM5 will be used to back-up hard disks in much the same way as tape streamers. I expect this is a reasonable idea, although it would be nicer to use a 5Mbytes floppy as primary rather than back-up storage. I suppose this will come when the price of the technology comes down.

plastic and looks and feels good, considering that it has been built down to a price. The unit is higher at the back than at the front which means that it is angled forward to give a good typing stance. This angle can be increased by flipping down two feet at the back.

The keys are laid out in three logical groups. The centre section is occupied by the main qwerty typing section. This is laid out in a similar manner to the PC/AT qwerty section — the '/' key has been moved away from between the 'Z' and 'Shift' keys, and the IBM PC's puny 'Return' has been replaced by the PC/AT's more substantial key.

To the left of the qwerty section, there are 10 programmable function keys *a la* IBM PC and PC/AT. To the right of the qwerty section is the combined numeric keypad and cursor keys. Above this are the 'ESCape', 'Num Lock' and 'Scroll Lock' keys. I still can't get used to the idea of having the ESCape key on the right of the keyboard instead of in the top left-hand corner where it belongs.

While the overall layout of the Epson PC keyboard was OK by IBM-compatible standards, I was disappointed that there were no LEDs to indicate that Num Lock, Scroll Lock and Caps Lock were engaged. Even the IBM PC/AT has these LEDs, and it seems strange that Epson decided not to include them on a machine with so many other attractive touches.

I like the general feel of the Epson PC keyboard. Considering that Epson had to build it to a price, it feels quite substantial. The keys themselves are well sprung if a little dead in feel.

Software

As you would expect from a modern reputable, IBM PC compatible machine, the Epson PC runs the majority of IBM PC applications software. It happily ran the standard test programs such as Lotus 1-2-3 and Microsoft Flight Simulator.

The only possible grips with the applications software abilities of the Epson PC is its comparatively modest speed. A quick look at the Benchmark figures will show that the Epson PC hardly sets the world on fire in terms of speed. Other clones such as the Olivetti M24 are coming on for twice the speed.

The front panel houses two 5.25in disk drives and the 'Epson PC' badge

In perspective

It never ceases to amaze me that major companies are still jumping into the IBM PC-compatible market even at this late stage. I still don't see how all these companies can have any hope of shipping produce in any decent volume. All the evidence seems to suggest that it's only IBM, Compaq and Olivetti which are doing any decent business in the IBM market. Most of the rest are pretty unspectacular.

PC compatibles tend to compete either on price or on features; they are either cheaper than the IBM PC (which isn't hard) or they are faster/have more RAM/have more I/O ports. It's interesting to note that both the Olivetti M24 and the Compaq machines trade on features rather than price.

The Epson PC, on the other hand, is trading on price rather than on spectacular performance. The last PC compatible I Benchtested which tried to do this was the Commodore PC. I never liked this machine, it felt cheap and nasty and showed every sign of having been built to a price.

The Epson PC is more expensive than a large number of Taiwanese machines, though it is better built. It could be argued that the Epson will sit uneasily between the cheap Asian compatibles (even those from large retail chains such as Dick Smith where a Multitech configured similarly to the base model Epson PC can be bought for $2187) and the top-of-the-range compatibles, such as the Olivetti M24 (selling for $4109, in the Epson PC's base configuration). And I have a feeling that there are more people who want a well built, high-performance PC-compatible and who don't mind paying a reasonable amount more. I would recommend the Olivetti M24 to this group.

Overall, the Epson PC deserves to do well but its current price may hinder sales.

Incidentally, when I tried to run the *APC* Benchmarks it turned out that in its haste to nick PC-DOS, Epson included IBM's Basica on the system disk rather than the more usual GWBasic. Needless to say, Basica wouldn't run because the Basic ROM routines are copyright IBM and are, therefore, not in the Epson ROM. In order to run the Benchmarks, I used an Olivetti M24 version of GWBasic. This worked just fine. Epson will be providing GWBasic on production versions of the machine.

Documentation

The review machine was supplied with three Epson manuals: *Setting Up and Getting Started, Everyday with MS-DOS* and the *MS-DOS Reference Manual.* All the manuals are spiral-bound and typeset and they all make heavy use of examples and illustrations. In general, quality was very high.

I found the most useful was the *Setting Up and Getting Started* manual. This provided helpful information such as the location of the on/off switch, and how to get inside the machine. It also has a short, if basic, trouble-shooting section.

The *Everyday with MS-DOS* manual is also helpful and easy to understand, with examples of how to use the Epson-specific utilities, how to partition a hard disk, and so on. All in all I was very impressed.

Prices

The base model, with twin 360k disk drives and 512k of RAM retails for $2940, excluding monitor and video controller card. A single 360k disk drive, one 20Mb hard disk system costs $4740. For a colour monitor and controller, add an extra $1200 to each system.

Conclusion

The Epson PC has only one significant asset: the way it looks. For an IBM PC clone, the Epson PC is positively pretty. It is compact, looks well made and has a certain designer flair not found on other PC clones.

When you open up the lid and look inside, the impression of being well built continues. All the electronics are made in the best Japanese traditions of neatness and compactness. The only major gripe is that the user is left with only two PC expansion slots which can easily be used up.

I suppose that Epson thinks that because this is a low-end machine, it is unlikely to be used by sophisticated users who want a lot of add-on cards. I think that this could be short-sighted, especially on the 20Mbytes hard disk version which should be capable of handling the most sophisticated user.

Overall, the Epson PC is one of the best moderate-priced IBM PC clones I can think of. It's not very fast and could run out of expansion slots, but it is well designed and put together.

END

Technical specifications

Processor:	80C88 running at 4.77MHz
ROM:	16k
RAM:	512k without using expansion slots. Max 640k
Mass storage:	Two 360k IBM PC-copatible floppy disks Option 20Mbytes internal hard disk.
Keyboard:	83-key IBM PC/AT-style
Size:	365mm (width) x 376mm (depth) x 145mm (height)
I/O:	RS232, Centronics, three IBM expansion slots (two free)
DOS:	MS-DOS V2.11. GW Basic

Benchmarks

BM1	1.4
BM2	4.9
BM3	10.4
BM4	10.8
BM5	11.5
BM6	20.8
BM7	32.4
BM8	34.3
Average	15.8

All timings in seconds. For a full listing of the Benchmark programs see End Zone.

BUSINESS STARTS LOOKING UP WHEN YOU IMPROVE YOUR YELLOW PAGES ADVERTISING

If you're already in the Yellow Pages why not look at ways to improve your advertising? Investigate additional classifications to extend your market reach. Consider different sized display ads, or using colour red, so more customers will see you first.

Perhaps all you need is something as simple as giving the look and message of your advertisement a facelift. Why not discuss it with your Yellow Pages advertising representative? We will be pleased to help improve your business prospects.

For detailed information and inquiries, contact the official advertising contractor. In N.S.W. and the A.C.T. call Edward H. O'Brien Pty. Ltd. on **(02) 929 6966** or **(008) 42 6311** (local call fee only).

In other States, contact Australian Directory Services, Vic. **(03) 269 2444;** Qld. **(07) 347 1111;** S.A. **(08) 333 8111;** W.A. **(09) 362 0888** and Tas. **(002) 34 4555.**

Telecom Yellow Pages

More business for your business.

YP75

Prevention or cure?

Illegal software copying is costing the software industry tens of thousands of dollars every year, but for some inexplicable reason people fail to appreciate that it is morally, as well as criminally, wrong. Bruce Everiss and James FitzSimons investigate.

Fundamentally, illicit software copying is a problem for psychologists, an abnormal quirk that requires analysis and explanation. Take Mr Average: he is no more likely to steal a computer from a computer store than he is to mug an old lady for her pension. Our same Mr Average, however, has no compunction about copying commercial computer programs. Morally and legally, the two acts are the same — criminal theft: unlawfully depriving another of their rightful property. The problem is not just with individuals but with society as a whole, the mass consciousness.

Back to Mr Average. Stealing a computer is something that would attract a guilty conscience: something to be quiet about. Stealing software, conversely, can be loudly proclaimed from the nearest hilltop or bar stool without fear of admonishment. In fact, if the software has been protected by its author, the criminal act of stealing it can lead to admiration. Queen Victoria would turn in her grave.

Definition

However, this piracy problem is not unique to the software industry: it applies to all intellectual property. The Russians spend millions harvesting the Western world of ideas: it's obviously much cheaper to steal finished working ideas than to utilise their own resources, and the Western world doesn't notice that its ideas are missing because they are not tangible. They can be in two or more places at the same time. It is only when our ideas are directed back at us in radars, missiles and jet engines that we feel any sense of loss or discomfort.

Intellectual property has become a mass consumer product in several, closely related forms. These are the printed word, as in books; music, as in records; cinema, as in videos; and, of course, computer software. Their similarities are striking and go far beyond their shared propensity to theft. All are used mainly to entertain, yet can be used for infinitely much more. Each is limited only by the human imagination. Everyone is subject to imagination. Everyone is subject to changing fashions, yet has timeless classics. They create celebrities and sudden wealth.

The weakness of all intellectual property products is their need for an intermediate medium to carry them. It is only in this way that they can be replicated excactly and distributed to the public at large, so an idea can exist in several different places simultaneously. The intermediate medium takes many forms, among which are paper magnetic tape, vinyl and optical disks. It is these media which are the cause of many piracy problems. Firstly, customers think, to a lesser or greater degree, that it is the medium that they are buying, not the intellectual property embedded in it. Secondly, it is often relatively easy to copy between the same and between different mediums; for instance, tape to tape and disk to tape. Thirdly, the medium can usually be bought blank. The problems of media can be overcome when intellectual property is sold on a usage rather than an ownership basis, examples of which are going to a cinema, renting a video and playing an amusement arcade machine.

The beginning of the end?

Home computer software became a mass market in late 1982/early 1983. It quickly attracted theft, though initially the main problem was professional

counterfeiting, rather than the schoolyard criminal. The problem attracted little credibility because it was masked by the explosive growth in the market. When sales were doubling every month, it was easy to be complacent. Eventually, however, the effects were felt by the software houses. The microcomputer press were accustomed to the complacency and were slow to adapt.

It was only with the first decision by a single judge in the Apple v Computer Edge case which held that there was no copyright in software, that the software industry fully concerned itself with the problem of piracy.

Commercial counterfeiting

Commercial counterfeiting is very profitable because the media and packaging costs of software are very low. Software houses have to pay a good deal for the research and development in bringing a program to the public as well as the advertising and marketing expenditure. Software pirates pay nothing for research and development and usually very little on marketing; a sophisticated package which sells for $900 in this country can be sold by a counterfeiter for $100 and still return a profit of 1000% to the counterfeiter.

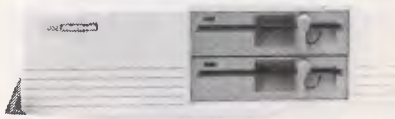
A particular source of pirated software in Australia is from Singapore and Taiwan. The Governments in these two countries recognise that an excellent

WHAT PRICE ? IBM COMPATIBILITY

IT'S HERE!

". . . . pretty impressive for a machine that is truly IBM compatible and, apart from memory restrictions, will run, as far as I have been able to ascertain, any IBM piece of software straight out of the box with no trouble at all. All for less than $1,400."

Gareth Powell, Computer Editor, Sydney Morning Herald



THE ALL NEW DSE Multitech

$1395

ACC Credit Line

Model shown is twin disk drive 'System 2' — see below.

Monitor shown not included in price.

Gareth Powell again: *"If you want to go a step further there is an extended machine with 256K of random access memory, MS-DOS and two disc drives. Or you can go even further to a system with a hard disc . . . Even more important than the price is the fact that with the two upmarket packages Dick Smith Electronics will install the system in your office or home free — and will also provide you with six months' on-site service . . . ."*

Yes! The highest quality — at the lowest price. That's the new DSE Multitech. We've looked at hundreds of compatibles overseas: the Multitech, from possibly the largest manufacturer outside the US, is the only one that meets our stringent quality standards.

And we back up this quality with rigorous QC, installation, on-site service . . . everything today's business demands. We can supply!

If you've been thinking about a computer for your business, but have been put off by the price, now's the time to think again. To quote Gareth Powell once more: *"What all this means is that full-scale computing power is now well within the reach of the smallest business".*

Want to see the rest of Gareth Powell's article . . . and a copy of the all-new DSE Multitech Computer Information Pack? Send in the coupon below. There's no obligation!

Want a test drive (and an information pack)? Call into your nearest DSE Computerstop store. You'll be glad you did!

Choose the system you require:

System 1: 360K disk drive, 128K RAM & MS-DOS 2.11. The ideal way to start! Cat X-8000 **$1395**

System 2: Two 360K drives, 256K RAM, MS-DOS 2.11, "EASY" word processing package PLUS six months' on-site service. * Cat X-8002 **$1995**

System 3: The powerful work-horse: Fully expanded with one 360K drive, one 10Mb hard drive, 512K RAM, "AURA" integrated business software (word processing, database, spreadsheet & information management) PLUS six months' on-site service AND free installation. Cat X-8003 **$3995**

* Capital Cities (exc. Darwin) & Newcastle only

DICK SMITH ELECTRONICS COMPUTERSTORE

• NSW • Albury 21 8299 • Bankstown Square 707 9888 • Blacktown [illegible] • Blakehurst 546 7744 • Bondi Junction 387 1444 • Brookvale 93 0441 • Campbelltown 27 2199 • Chatswood Chase 411 1955 • Chullora 642 8922 • Gore Hill 439 5311 • Gosford 25 0235 • Hornsby 477 6633 • Liverpool 600 9888 • Maitland 33 7866 • Newcastle 61 1896 • North Ryde 88 3855 • Parramatta 689 2188 • Penrith 32 3400 • Railway Square 211 3777 • Sydney 267 9111 • Tamworth 66 1961 • Wollongong 28 3800 • ACT • Fyshwick 80 4944 • VIC • Ballarat 31 5433 • Bendigo 43 0388 • Box Hill 890 0699 • East Brighton 592 2366 • Coburg 383 4455 • Essendon 379 7444 • Frankston 783 9144 • Geelong 43 8522 • Melbourne 67 9834 • Richmond 428 1614 • Springvale 547 0522 • QLD • Brisbane 229 9377 • Buranda [illegible] • Chermside 359 6255 • Rockhampton 27 9644 • Southport 32 9863 • Toowoomba 38 4300 • Townsville 72 5722 • SA • Adelaide 212 1962 • Darlington 298 8977 • Enfield 260 6088 • Salisbury 281 1533 • WA • Cannington 451 8666 • Fremantle 335 9733 • North Perth 328 6944 • Perth City 321 4357 • TAS • Hobart 31 0800 • NT • Stuart Park 81 1977

Or order through DSXpress with your Bankcard, Mastercard or VisaCard: Just phone (toll free) (008) 226810 for fast despatch of your order. (Sydney calls or enquiries please phone (02) 888 2105 or write to address at right)

Want to know more? Send for your FREE information pack. It's obligation free.

Name:

Address:

Postcode: Phone:

Drop into any Dick Smith Electronics store or send to DSXpress (PO Box 321, North Ryde NSW 2113)

B066

method of ensuring that a large portion of the population is computer literate is to foster conditions in which the majority of the population can afford to own a computer and a wide range of software; there is no doubt that the availability of pirated software means a wider distribution of that software. The benefit to a country of having a large computer literate population is that in years to come the population will be able to provide programming and other computer related services to the world which already finds itself short of suitably trained people. The dilemma is that corporations are suspicious of establishing a factory or programming unit in a country where they are virtually unable to prevent their technology being stolen.

There is no doubt that a software piracy industry exists within Australia as well. John Le Fevre a journalist with *Computing Australia* recently exposed a Melbourne firm which attempted to sell him Lotus 1-2-3 and WordStar packages which had been copied in his presence. It appears, however, that Imagineering, the distributor of these products, will take no action.

Other methods favoured by pirates in this country are inducing the sale of hardware (usually clones) by offering to provide vast amounts of software for merely the cost of the diskettes which carry it or to advertise a software library which allows members to borrow software for up to a week. Of course, the proprietors of such libraries warn members against the illegality of unauthorised copies; they don't, however, provide the software in write protected disks and they seem not to recognize that even making a loan of software may be a breach of the licence under which they obtained the software.

Cure

It is ironic in Australia that the law relating to the copying of software has been clarified due to the action taken by Apple, essentially a producer of hardware. On May 25, 1983 Apple launched its case against Computer Edge Pty Ltd and Michael Suss claiming that Computer Edge was selling illegal copies of the Apple II. The major infringement claimed by Apple was of its copyright in certain programs written for Apple and which Apple embeds into ROM chips in its Apple II computers. Apple claimed that copies of these programs could be found in the Wombat computers sold by Computer Edge.

The result in the Apple v Computer Edge case is well known and has been widely reported not only in Australia but around the world. Essentially, the Full Court of the Federal Court of Australia found that software comes under the umbrella provided by the Copyright Legislation and that, therefore, a person who without authority makes a copy of a computer program infringes the copyright of the author or authors of that program. This is so whether source code or object code is copied.

Because of the intense discussion which took place in Australia after the case was initially heard by a single judge, the Federal Government moved to amend the Copyright legislation and on June 6, 1984 the Copyright Amendment Act 1984 was passed. This Act ensures that software does, indeed, have the full protection of copyright law. The High Court of Australia heard an appeal in the Apple v Computer Edge case in March 1985, although the decision of that Court is eagerly awaited, there is no doubt that the copying of software without permission is illegal.

Singapore has recently introduced tough new copyright laws which will send copyright pirates to jail if caught. Taiwan has also amended its copyright

To find out how the new Corona Mega PC works twice as fast, yet costs less, please send for our brochure.

Name _____ Position _____

Company _____ Address _____

_____

Postcode _____ Telephone _____

AWA COMPUTERS

132 Arthur Street, North Sydney NSW 2060

AW 71

law, but the protections apply mainly to Taiwanese citizens. It has recently introduced very strict patent laws as well.

Ironically, given their stance mentioned above, Imagineering was one of four firms which recently joined together to create the Anti Software Piracy Association in Hong Kong. Despite publicity surrounding its formation there have been few reports of the success of the ASPA although it may still be too early to expect results.

Prevention

Having the force of the law is all well and good, but it is a well-known fact that some people break the law. The only way to get true protection, is to make the program copy-proof. Software houses have introduced successively better protected products and software thieves have come up with successively more sophisticated copying methods.

Pirates have their own answers and programs exist which are designed to get around the known copy protection mechanisms. Going under names such as "Gobbler" or "Cracker" these programs can be used to make unlimited copies of supposedly protected programs.

The only real protection is to require something external to enable the program to work, and these solutions are now appearing.

Alan Maton is the managing director of Software Projects. Each of his programs comes with a Software Protection Card, a piece of cardboard on which are printed a large number of four-colour combinations. When the program is loaded, it asks for the combination at a randomly chosen and specific location on the card. Type the combination in and away you go. The method is cheap and simple and effective. The first program protected in this way was *Jet Set Willy*, but users quickly found out how to take the protection routine out of the program. Alternatively, they wrote down the contents of the whole card long hand. After a couple of months, one magazine irresponsibly printed the method to beat the protection system. On the company's latest products, the routine is very well hidden and virtually impossible to remove. Also, the card has many more locations (3400), making its copying a *magnum opus*. Alan has bet a number of keen hackers $100 that they cannot beat the system now — none of them has collected.

'Having the force of the law is all well and good, but it is a well-known fact that some people break the law. The only way to get true protection is to make the program copyproof.'

Other systems are also being used. For instance: after loading a program, a two-character password is randomly generated by a software routine. The characters are scrambled horizontally and appear on the screen. The customer looks at the characters through a prism which unscrambles them and he types the characters in. The program then runs. The two characters on the screen change every 10 seconds, so you can't cheat with a pencil and paper. To copy the prism with a plasticine mould is futile, as it is necessary to get the right refractive index of plastic. As to removing the routine, prevention is the responsibility for the software house. By splitting it up and spreading it round and using checksum detection, it can be made just about impossible. The cost of

THE EPSON COMPUTER SPECIALISTS

PORTABLE COMPUTERS

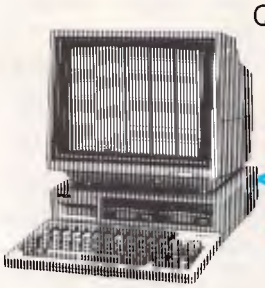
PX-8

PX-4

HX-20

DESKTOP COMPUTERS

Qx-11 MSDOS



NEW RELEASE
EPSON PC AVAILABLE NOW

Qx16 CP/M + MSDOS
DUAL PROCESSOR

12 months warranty on all hardware products

PRINTERS

BUSINESS

FX85
FX105
RX100+
LQ1500
SQ2000

TECHNICAL

LX80
JX80 7 Colour
Hi-80 Plotter/Printer
GX-80 — Commodore
— Apple IIc
— Parallel
— IBM Graphics

PERSONAL

P-40 Portable
P-80X Portable

SOFTWARE

INTEGRITY BUSINESS SOFTWARE

— Accounting One
— Ascent
— Horizon

SOFTWARE FROM

— Ashton-Tate
— Microsoft
— Borland
— Digital Research
— Micropro

PPC PROFESSIONAL PERSONAL COMPUTING PTY. LTD.

720 Heidelberg Road, Alphington, Victoria 3078. (03) 49 3123 — 49 3122

C.A.E. ELECTRONICS

P.O. Box 62, Blacktown, NSW 2148
202 Sunnyholt Road, Corner Vardys Road, Blacktown, NSW. (02) 671 6951 — 621 4242

all this is about 30 cents per tape.

Success

If copy-proofing techniques were universally adopted, how much more software would be sold? The answer, based on the example of the video industry, is about 20 per cent. The simple fact is that customers only have so much money to spend. Just because someone copies a program, it doesn't mean that they would have bought it if it were copy-proof. The average user has thousands of dollars worth of software at retail prices; there is no way that he can ever be made to buy a fraction as much.

A major argument with software is its price. It has the most debatable value of all the intellectual property products. Compare the price of a computer game with that of a paperback. The customer often feels that he is being overcharged and is, therefore, more likely to copy: a chicken-and-egg situation. The higher the prices the more copying, the lower the prices the less copying.

Of course, it is not just customers defrauding software houses; software houses also defraud customers. There are very few original games; many are just copies, to a lesser or greater extent, of others.

Imagine the poor customer having spent his hard-earned wages or pocket money, only to get home and find that he has just bought a slightly changed version of a game he already has, only with a different name and from a different software house. *Atic Attack* and *Underwurlde* from Ultimate were blatantly copied in this manner. A hit boxing game with celebrity tie-in, is a blatant copy of *Nintendo Punch Out.* One software house alone has produced almost exact copies of *Manic Miner, Defender* and *Commando.* David Lawson owned his brief fame mainly to *Arcadia*, yet it is largely a copy of the Apple II game,. *Threshold,* from Sierra On Line. When you think that the potential and variety of computer software is limited only by the human imagination, there is simply no excuse for such blatant plagiarism. The software industry should get its act together and stop defrauding the customer in this manner. Until it does this, it is in moral quicksand when complaining about software theft.

Conclusion

Illicit software copying is a complex subject. It encompasses philosophy, human nature, the law, commercial reality and a variety of technical matters. This article serves merely as a gentle stroll through some of the issues involved. Many areas are the subject of intense debate and will no doubt remain so.

To the future: it is inevitable that an increasing percentage of software will be technically protected. This gives the customer added cost and inconvenience, but it is the only real solution for the software houses, the new act notwithstanding. The problems of high price and plagiarism by software houses do not lend themselves to easy solutions. Here, perhaps, the press could usefully use its power to do something in its readers' interests.

James FitzSimons is a solicitor with the Sydney firm Abbot Tout Creer and Wilkinson.

END

BBC Master 128

Its old-fashioned appearance notwithstanding, the MS-128 is the base model of Acorn's Master Series and is an attempt to upgrade and improve the BBC Model B. It's even cheaper than the existing BBC, so how will it fare? Nick Walker finds out.

Since its introduction in 1982, the BBC Model B has gained a reputation as the 'good all-rounder' among medium-cost micros, and not without reason. The Model B is currently being used in more diverse applications than any similarly-priced micro. The thousands of available applications, combined with the BBC's comprehensive connections to the outside world, make the machine a capable small-business micro, a scientific control instrument, a communication system and a multi-purpose home computer, to name but a few of its uses. This all-round capability resulted in the BBC becoming a natural choice for education establishments, so much so that its distributor, Barson Computers, claims it is one of the two most popular microcomputers in Australian schools.

Due to its firm establishment in such areas as schools, the BBC didn't become involved in the early round of price-cutting of home computers. Also, Acorn had a new cut-down version of the Beeb with which to compete — the Acorn Electron, launched in 1983. Sadly for Acorn, the Electron didn't make it, and another round of price-cutting left the Model B uncomfortably expensive. In line with other manufacturers, in 1985 Acorn launched a larger-memory version, the BBC B+ but, like the Model B, the price — $1584 — could hardly be considered competitive.

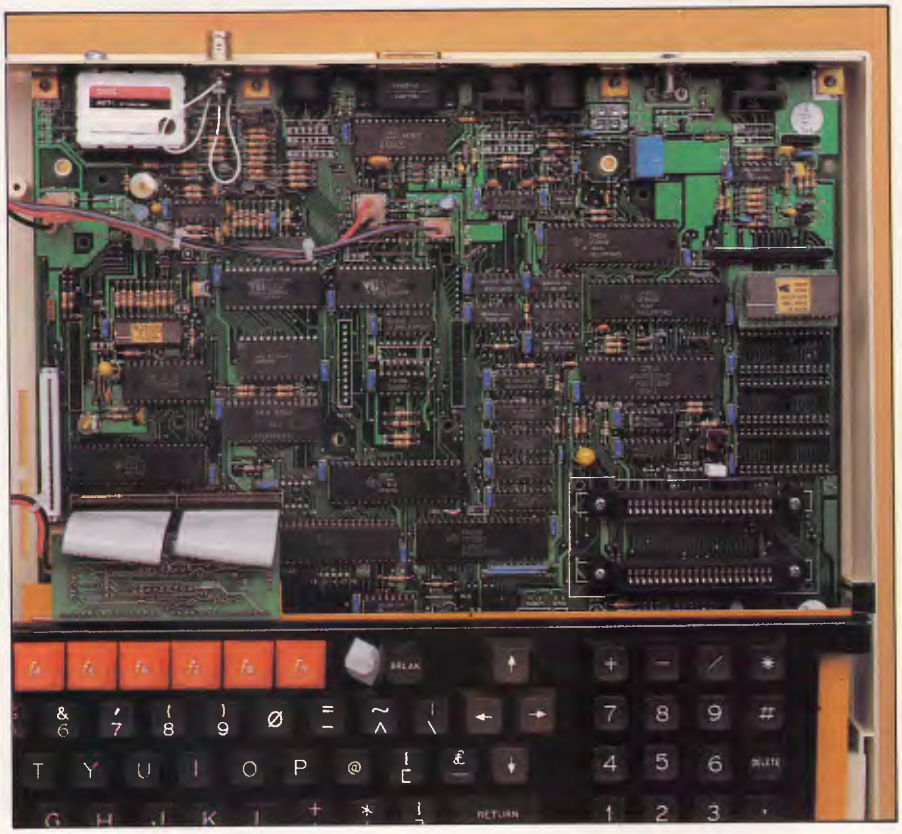
Acorn's latest offering is not one, but a series of five machines called the Master Series. Like the original Model B, this series has the full backing of the BBC. The base model is the Master Series 128 (MS-128) which replaces the BBC B+ as the 128k derivative of the Model B (the Model B ceased production in 1985), and it is this machine that is the subject of this Benchtest. The other four machines are all based on the MS-128, and all but one can be purchased as an expansion to the base model. They are: a go-faster version, the MS-Turbo; a 512k 16-bit business version, the MS-512; a scientific 32-bit version, the MS-Scientific; and a stripped-down version for use as an Econet network workstation, the MS-ET.

Hardware

The MS-128 may have grown in all three dimensions, but it still looks very much like the Model B. The casing is finished in the same fawn plastic, and the keyboard is once again black with red function keys. Not that I'm complaining — the overall look reflects a high quality of construction and a good, solid feel. It is, however, in appearance, the most old-fashioned low-cost micro currently available.

There are, in fact, a number of external differences from the Model B, the most obvious of which is size. The perspex strip which holds function key legends is now raked sharply upwards to give 1½ins of extra height. This extra height combined with a deeper case, forms a substantial plateau of fresh air on the MS-128. This is not, as original BBC owners may suspect, to provide extra cooling, but to create sufficient space for expansion into the other machines of the range and internal peripherals. Incidentally, the steep angle of the function key legends makes it easier to use as it can now be read from an upright typing position, whereas on the Model B you have to bend forward to find the function you want.

I was told that the case, which is really quite large for its kind, would be able to support a monitor in order to reduce the



The PCB closely resembles that found on the unreleased ABC boards

NEW!! TOOLS FOR C PROGRAMMERS FROM HI-TECH SOFTWARE

HI—TECH C COMPILER

The HI—TECH C Compiler is an all-Australian high-performance C compiler for the Z80 and 8086/8088 processors.Now in use at thousands of sites in Australia and overseas, it combines an excellent user interface and diagnostic messages with smaller, faster generated code than any other compiler. It runs on CP/M-80, PC-DOS, MS-DOS, CP/M-86 and Concurrent CP/M. It allows for the generation of ROM based code and comes with a macro assembler, linker and librarian. The 8086 compiler supports large and small memory models and the 8087 maths co-processor. A cross compiler running under MS-DOS and producing code for the Z80 is also available.

Prices

8086 Compiler for MS-DOS or CP/M-86	$300.00
Z80 Compiler for CP/M-80	$250.00
Z80 Cross compiler for MS-DOS	$300.00

SNAKE

SNAKE is a utility for MS-DOS functionally equivalent to the Unix MAKE command. It automates the recompilation of any modified modules of a programme. This is an indispensible tool for any serious programmer using C or any other compiled language.

Prices

SNAKE	$89.00
SNAKE + BTree + ISAM	$249.00

BTREE & ISAM

BTree is a b-tree based index and data file manager supplied in C source code form. ISAM is a higher level set of routines providing powerful database management, also in C source form. ISAM requires BTree.

Prices

BTree	$119.00
BTree + ISAM	$179.00

A BOOK ON C

"A Book on C" by Al Kelley and Ira Pohl is an indispensable guide for every C programmer, whether a beginner or an experienced professional. An excellent introduction and a comprehensive reference to the C language, it has many examples and working programs.

Price: $32.95

MACRO ASSEMBLERS

HI-TECH Software has macro assemblers to run under MS-DOS or CP/M for the following micros: 8080, 8085, 8086, 80186, Z80, NSC800, 6800, 6801, 6805, 6809, 6301, 6303, and 64180. All use standard manufactures mnemonics and come with a powerful linker librarian and object code convertor. The assemblers produce absolute or relocatable code and Intel and Motorola Hex formats are supported.

Prices: $250.00

FUJI FLOPPY DISKS

We use only top quality Fuji floppy disks for our software. These disks are second to none in quality and carry a lifetime replacement warranty. Due to our high volume buying we can offer them to you at big savings. Some examples: (per box of 10).

5¼" DSDD	$42.00	5¼" SSDD	$31.00
3.5" SSDD	$67.50	3.5" DSDD	$87.50

DELIVERY CHARGES (via TNT Air)

Software	$8.00
Books	$6.00
Floppy Disks	$6.00

Only one delivery charge is payable per order, e.g. if you order software and floppy disks you pay only $8.00 for the whole order.

PHONE YOUR MASTERCARD, VISA OR BANKCARD ORDER TODAY ON (07) 38 3852 or write to:

HI-TECH SOFTWARE
P.O. BOX 103, ALDERLEY, QLD, 4051.
11 PAVONIA ST., ASHGROVE, QLD., 4060
Ph. (07) 38 3852
Call our 24hr 300bps Bulletin Board on (07) 38 6872

The Computer Trader

Phone Order Specials
(03) 266 1995 (Reverse Charges)

we won't be beaten on PRICE!

SUPER TRADER SAVINGS

"No-one offers this Preferential Price & Performance Plan"

We call it 4P. It enables us to provide you with the convenience of your local computer shop and the technical support of a professional consultant.

Add up the benefits:

1. TRADE DISCOUNTS OF UP TO 35% ON R.R.P – The Computer Trader purchases substantial volumes of hardware and software each month. *You benefit from our purchasing power by receiving the lowest prices available and first option on limited offer Supertrader Specials.*
2. FREE CATALOGUE – The countless hours spent each month in "shopping" for new products and in updating your knowledge can be minimised by 4P. On registering in 4P you indicate your hardware and software preferences and we prepare a catalogue tailored to your needs.
3. IMMEDIATE DELIVERY DOOR TO DOOR – If products are in stock we will have them delivered overnight to your door. A "rush" delivery fee is charged to non 4P members for this service.
4. MANUFACTURERS WARRANTY – All products supplied by The Computer Trader carry a full manufacturer's warranty. Any claims made against this warranty by 4P members will be followed up by The Computer Trader provided the terms of the warranty have been complied with.
5. THE COMPUTER TRADER 30 DAY MONEY BACK GUARANTEE – As a 4P member we will refund your money on any purchase from The Computer Trader which does not comply with the manufacturer's published specifications regardless of whether or not the default is covered by the manufacturer's warranty.
6. FREE INFORMATION SERVICE – In addition to our free catalogue 4P members receive regular bulletins on newly released products, special buys that become available and other items of interest that may not be published in the Australian press.
7. LOCAL & OVERSEAS BUYING SERVICE – If we do not already have the product you require, our experienced consultants will trace it for you–either locally or overseas.
8. CORPORATE ACCOUNT PROGRAMME – More than 50% of our clients are corporate or government organisations. The Computer Trader will supply these organisations on a purchase order basis provided they comply with our payment terms.
9. QUANTITY DISCOUNTS – The Computer Trader will offer additional discounts for volume purchases.
10. Software rentals for 4P members only–on application.
11. FREE TECHNICAL SUPPORT–We have retained the services of a team of highly qualified and independent micro computer consultants who are available to answer technical queries on all products purchased from The Computer Trader. *Their support is available on our special hotline free of charge to 4P members.*

		RRP	Our Price
1.	Lotus 1-2-3	835	535
2.	Multimate	745	439
3.	Open Access	995	665
4.	Symphony	1095	725
5.	Multiplan	365	295
6.	Microsoft Word	595	465
7.	Wordstar	445	340
8.	dBase III	976	645
9.	Attache	775 p.m.	CALL
10.	Dataflex	N.A.	CALL

Courtesy PC Australia

TOP SYSTEMS

	List Price	Our Price
1. IBM PC "XT" 10Mb, FDD & 256K, (Colour +425)	6252	4845
2. Olivetti M24 "XT" 10Mb, FDD, 256K (Colour +625)	6522	4595
3. IBM Compatible It's got everything incl. 10Mb & 512K..	N/A	2985

NOTE: Add $300 for 20Mb and from $200 for 256K RAM.

HARDWARE

Printers	*NEC – P2/P3 Pinwriter (Colour + 225)	850/1195
	*NEC-P5 Pinwriter	CALL
	*Epson – LX80	415
	Colour Printers & Plotters	CALL
	NEC – Spinwriter E.L.F.	695
	Epson–FX85 (FX105 $995)	775
	Brother new models	CALL
	C-Itoh, Toshiba, Silver-Reed & others	CALL
Monitors	*Taxan Hi Res. Vision III Colour	650
	Taxan Hi. Res. Amber or Green	249
	BMC Composite	159
	Other Brands	CALL
Disk Drives	*Hard disk 10Mb internal	from 1250
	*Hard disk 20Mb internal	from 1495
	Slimline Floppy – 360K direct drive	285
	Floppy Drive – 360K	250
	Hard disk greater than 20Mb	CALL
All quality brands: Tandon, Tallgrass. Rodime NEC & Seagate.		
Tape Back-up	*Cipher 32 Mb internal	1695
	Sysgen 10 Mb	1595
Boards	*Multifunction Card	from 295
	*Colour/Graphics Card	285
	*Mono/Graphics Card	325
	Persyst, Sigma, Orchid, Qubie, & Paradise – excellent prices	CALL
Modems	PC In-Modem 1200/75	685
	Viatel Modem	CALL
	Sendata/Netcom	CALL
Floppy Disks	*Nashua DSDD	39
	*Top Quality Brand DSDD	25
	Disk storage unit (90 disks)	22
	Other Brands and Sizes	CALL

SOFTWARE – MACINTOSH

Business	Omnis 3	565
	Jazz	665
	Thinktank	255
	Microsoft	CALL
	Other	CALL
Entertainment	Baron	69
	Millionaire	69
	Zork II/III	59

SOFTWARE – IBM

Spreadsheets	*Lotus 1-2-3	535
Integrated	*Symphony (Vers 1.1)	725
	Enable	765
	Framework	750
	Multiplan	285
	Open Access	665
	Supercalc. 3	399
Database	*dBASE III	645
	*Versaform	199
	Knowledgeman	580
	Quickcode III	325
Word Processing	*Wordstar	340
	*Multimate (advantage +80)	439
	Perfect Writer II	295
	Wordperfect	439
	Microsoft Word and Spell	495
Languages	*DeSmet C	195
	Turbo Pascal (toolbox +62)	79
	*Borland Int. (Turbo)	CALL
	Digital Research	CALL
	Microsoft	CALL
Utilities & other	*dTOOLKIT	99
	*Typequick	69
	*Smartkey	69
	Superkey	72
	Thinktank	215
	Sideways	79
	Norton Utilities (Ver 3.0)	145
	Copywrite/Disk Explorer	95
	Sidekick	89
	GEM incl. desktop and drawer	CALL
	Eightymate (runs CPM80 prog. under MS-DOS)	295
	PC Alien	89
	All others	CALL
Communications	*Crosstalk	175
	*Smarterm 100 (DEC Emulator)	250
	*Smarterm 400 (D.G. Emulator)	250
Entertainment	Flight Simulator	95
	Sargon III	65
	All Others	CALL
Accounting	Integrated–Drs/Crs/GL/etc.	CALL
	Information–Business Manager1	385
	Information–Payroll	299
	Integrity–Accounting one	595
	Integrity–Payroll	495
	CPA+	680
	Sybiz	CALL
	IAL	CALL
	Vertical Market	CALL
Project Management	*Timeline	485
	Harvard Project Management	495
	Microsoft Project	545

***SUPERTRADER SPECIALS**

NO MORE WORRIES

with our free HOTLINE SUPPORT

ANY PRODUCTS NOT LISTED – CALL, CALL, CALL!

BANKCARD & VISA CARD ACCEPTED – TERMS: PAYMENT ON RECEIPT OF GOODS

MANUFACTURERS' WARRANTY ON ALL PRODUCTS

Handling charges $7.50 on all software, boards and accessories. In the unlikely event that our costs change without notice we reserve the right to alter prices.

The Computer Trader, 98 Hoddle Street, Abbotsford 3067 Telephone: (03) 417 7044

When Olivetti specifies them you know they're reliable

TANDON AND DTC FROM MICRO GENERAL

No dealer's ever regretted going first-class with the disk drives he instals. After all, who wants future service problems? Tandon and DTC — world famous for quality identical to manufacturers' own equipment — are proven 100% compatible with all major micros: IBM, Olivetti, Ericcson, Sanyo, NCR, Canon, etc.

Best yet! Check Micro General's special *low* prices — they give you that edge you need to offer the best deals for less.

MICRO • GENERAL

10, 15 and 30 MB

10 MB, 40 MB

22MB formatted.

115 Church Street,
Camperdown 2050.
Tel: 550 2333.

DTC Controller

SEE US AT PC 86 STAND NO 913

8087 Co-Processors

256K DRAMS

64K DRAMS

total desk area needed for the system; it can't. A substantial area of desk space is needed for a complete system — in fact, more than traditional three-box business systems such as the bulky IBM PC, which is not really acceptable for a machine that may well find a home on a school desk or as a home computer. You may just be able to balance a monitor on it, but it hardly looks comfortable and I'm sure Acorn would frown at the idea.

To the right of the function key legends is a speaker grille, so sound output is noticeably louder and harsher than on the Model B, not having a solid case to muffle it. Happily for many users, it is now possible to switch off the sound without delving inside and disconnecting leads.

To the right of the grille is a small valley containing two cartridge sockets of the type found on, and compatible with, the Acorn Electron. My initial reaction upon hearing this was to cringe: while I'm generally in favour of the concept of cartridges, the computer industry has regarded them as nothing more than an expensive way of producing games for games consoles. I know of no micro where they could be considered a success.

It was a $40 extra that convinced me that the MS-128 cartridges have a much better chance of success. The extra bit plugs into a blank cartridge, and allows you to insert standard BBC ROM software. There is now a vast quantity of ROM-based software available for the BBC, but the average Model B owner has only four or five ROMs to choose from. More ROMs than this, and you risk damaging both the chips and the sockets each time you want to use one that isn't in the machine. With these cartridges, there is now no limit to the amount of ROM software you can sensibly use, and you don't even need to take off the lid to use it. The extra cartridges for the Electron will run on the MS-128, and each cartridge in this mode can hold up to 256k of ROM.

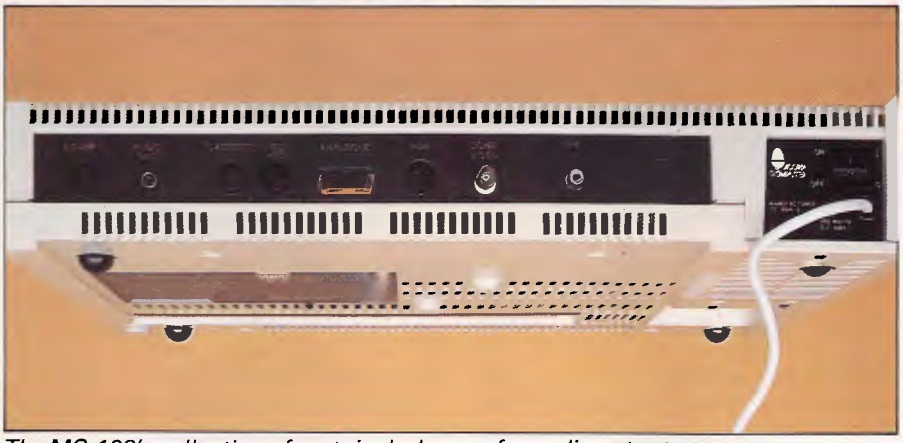
Along the back of the machine are eight ports — from left to right these are: Econet network socket; audio output; cassette connection; RS432 serial port; analogue port for joysticks and other analogue devices; RGB colour monitor; composite monochrome monitor connection; and UHF television output. The only difference here from the Model B is the welcome addition of an audio output, so you can connect the machine to a hi-fi and do justice to its capabilities. Also on the back, to the far right, is an on/off switch.

Five more I/O ports exist on the base of the machine, the same five that gave the Model B its reputation as the most expandable low-cost micro available. The five ports are: disk drive; parallel printer; user port; 1MHz bus for high-speed peripherals such as a Winchester drive; and the famous tube connection for second processors. It's nice to see that the tube hasn't been dropped on the Master series with its internal expansion capabilities; you can still attach the likes of Acorn's Z80 CP/M system and various third-party second processors. Also on the base there is a power supply output, which is usually used to power an external disk drive.

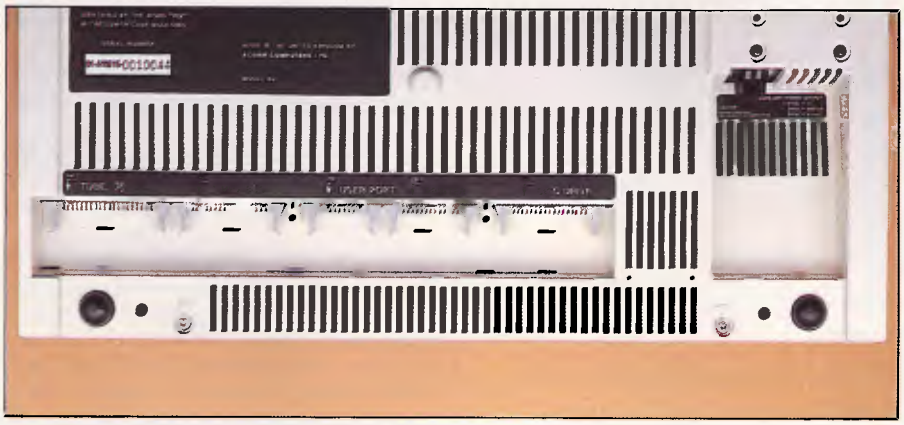
I was disappointed to see that these five ports are still the awkward backward ones found on the Model B, and still inaccessibly positioned on the base of the machine. More than a few users have cursed these sockets as difficult to use; teachers in particular have grown to hate them, as many schools have to fasten them down to stop pupils walking away with them. Once the micros become immovable, the ports become inaccessible.

The keyboard is an integral 93-key full-stroke affair, which both looks and feels good for the price. Some typists find that it is lacking a positive feel and is rather hollow, but it was adequate for my two-fingered efforts. Much of the keyboard is finished in black, and at the top right-hand side there are four brown keys which form a cursor key diamond — which is a big improvement over the Model B's peculiar arrangement. At the top of the keyboard there are 10 red function keys, giving a total of 40 functions when used alone and in combination with Shift and Control. To the right of the main keyboard there is a 19-key numeric keypad consisting of 10 numeric keys, four arithmetic keys, a decimal point, an equals sign, a delete key, a comma and a Return.

To get inside the machine you remove five Philips screws from the base, turn the machine over and lift off the lid. Once again you will be greeted by what Acorn claims is a totally new PCB but, while certainly differing from the Model B, it looks very similar to the board found on the unreleased ABC machines. The board is much less cluttered than the Model B's due to the use of six custom CMOS gate array chips. Even so, the board still contains an excessive amount of chips, which must make the machine expensive to produce. I would have thought that after four years of production it would be possible to drastically cut the number of chips. An Atari 520ST, for



The MS-128's collection of ports includes one for audio output



The five ports on the base include the tube connection for second processors

example, is a 16-bit 512k RAM machine and yet it only contains a fifth of the chips of the MS-128.

The processor in the MS-128 is a 65C12, a version of the good old 6502 running at 2MHz. It will not only run standard 6502 programs, but also adds some new commands to the instruction set. RAM, as you might expect, is 128k, made up of four 64k by 4-bit DRAMs. A single ROM chip of 128k contains the operating systems, two disk operating systems and a number of bundled applications. The six custom chips comprise: memory controller chip; peripheral bus controller; cathode ray tube controller multiplexor; keyboard controller; chroma chip; and I/O controller.

Not content with the external expansion facilities of the Master Series, there are more internal ports and sockets on this machine than any other similarly priced micro. Three sockets are provided for ROM chips, two 32k and one 16k, but with the two cartridge slots these only need to be used for software that you require every time you use the machine. Personally, I'd be tempted to use the 32k sockets in their second role as two 32k bank-switched RAMs, and leave the 16k socket empty. Sockets are also available for two co-processors, an internal modem (freeing the RS432 port for other tasks) and two sockets allowing easy installation of an Econet network board. Given all this possible internal expansion, it's not surprising that the machine has developed a 'hump' to incorporate them.

A small black plastic box in the lower right-hand corner contains a speaker and a long-life Lithium battery, which maintains a real-time clock and 50 strategic bytes of RAM when the machine is switched off. Most of the left-hand side of the machine is occupied by a hefty power supply, which is essential when you consider how much power is necessary.

The MS-Turbo has a 65C102 processor, which is a derivative of the 6502 running at 4MHz. It also has an extra 64k RAM and a special high-speed version of BBC Basic. With this combination, the MS-Turbo is claimed to have an average of 4.9 seconds on *APC*'s Benchmarks, which ranks it alongside the fastest 16-bit business micros that are many times more expensive. One obvious use for this machine is as a fast file server in an Econet network. The MS-512 is Acorn's business machine, offering an internal 16-bit 80186 second processor running at 8MHz. Top of the range, at least in price terms, is the MS-Scientific, which uses a National Semiconductor 32016 32-bit processor, also running at 8MHz. The MS-ET (Econet Terminal) is a cut-down and cheaper version of the MS-128 without the bundled ROM software, especially for use on an Econet network.

System software

It's a tribute to the original system software on the Model B that it has been possible to considerably expand the software on the MS-128 and yet maintain a high degree of compatibility. The latest version of the BBC operating system is known as MOS (Machine Operating System) and is now 35k in size, spilling over its allocated 32k into the ROM banks.

One of the biggest problems facing manufacturers of the new generation of 128k micros is how to make 8-bit microprocessors, such as the 6502 that was originally designed to access a maximum of 64k, address all the extra RAM. The MS-128 uses as convoluted a method as the rest, but to be fair it was never really envisaged, when the original micros were designed, that one day they might have to address 128k of RAM. It's hardly surprising that odd chunks of RAM are grafted on throughout the memory map.

The original memory map consisted of 32k user RAM, a 16k gap for sideways ROMs and a 16k operating system. This is maintained in the MS-128 and supplemented by a 20k block of RAM, which can be switched into the top 20k of user memory. A 12k block of RAM used by MOS sits uncomfortably across the ROM and O/S border; the remaining 64k is broken into four 16k blocks which compete with the sideways ROM to fill the 16k gap.

The bulk of the new operating system features cover graphics capabilities, which are explained in detail in the 'Applications software' section, with reference to their incorporation into Basic. A number of other features has been incorporated for the existing BBC programmer, and these consist of 17 OSBYTE calls, two OSWORD calls, 12 sideways ROM service calls and 43 base VDU functions. There are too many calls to discuss them all in detail, so I'll just describe one or two of the more interesting ones that can be accessed from Basic using the *FX command.

*FX 108 switches in the 20k chunk of RAM, known as the shadow memory, into the user area. Extreme care is required if this is done from Basic, as you are probably overwriting a screen, a stack pointer and variable tables. *FX 210 disables sound output; and *FX 22, *FX 23, *FX 142 and *FX 143 allow you to poll and service the ROM installed on the 128 from within a Basic program. The list goes on, covering many of the features that experienced Basic programmers asked for after the Model B.

Two disk operating systems are included in the 128k ROM: the original DFS (Disk Filing System), and Acorn's new hierarchical filing system ADFS (Advanced Disk Filing System). DFS needs little explanation: it's Acorn's original and generally very good filing system that had one major fault — there was a limit of 31 to the number of files in the disk directory. Originally this wasn't too serious on a small micro, but as third-party manufacturers produced bigger-capacity drives, it proved more of a problem. ADFS was launched in 1985 as the solution.

Happily, by making the filing system truly hierarchical, Acorn has produced a system which is quite capable of dealing with all types of disk drives, including Winchesters. The two systems are incompatible, although DFS commands will work under ADFS, so you will have to switch in DFS when running original Model B disks. I suspect that users of the MS-128 will happily forget all about DFS for their own work when they have experienced the advantages of ADFS.

As well as a hierarchical file structure, ADFS gives an increased formatted capacity of 160k per 40-track disk and 320k per 80-track disk; the use of both sides of a single disk as one entity (provided the hardware and disk design allows); and faster access to certain types of files, particularly on an Econet network.

The 50 bytes of battery-backed RAM provide a surprising amount of start-up options and system configurations. The easiest way to set these is via a program found on the 'Welcome' disk and cassette called Panel, which closely resembles the control panel found on the Apple Macintosh. *CONFIGURE is the BBC-like unfriendly way, but Panel provides a friendly, icon-driven way to configure 18 functions, including: setting of the real-time clock; screen adjustment to

Benchmarks

BM1	0.5
BM2	2.3
BM3	5.7
BM4	5.8
BM5	6.4
BM6	10.3
BM7	16.2
BM8	28.2
Average	9.42

All timings in seconds. For a full listing of the Benchmark programs, see End Zone.

Telecom

VIATEL® and Computer Communications

NOT JUST VIDEOTEX ALSO 300 BPS COMPUTER ACCESS

For your Micro

The MICROTEX 666

Communications Packages for IBM, Apple, BBC and Commodore 64.

Expand the horizons of your personal computer.

These packages provide all you need to access Videotex, Microtex 666, Bulletin Boards and other computers.

y now you've all heard about Viatel – the exciting new ay to do everything from your own banking and ıopping to software purchases and electronic mail, plus vast store of information from share prices to airline metables. And here's how to gain access via your own ersonal computer.

ıe Microtex 666 package provides:

MODEM. Reliable, error-free communication with top quality odem. Videotex access at 1200/75 for Viatel, Farmlink, Prestel c. Glass teletype access at 300/300 for bulletin boards d other data bases. e.g. Information Express, lememo, Midas etc. Complete with push button ndset (use as second phone).

VIDEOTEX COMMUNICATIONS SOFTWARE. order to decode the Viatel transmissions and display aphics. This software turns your personal computer into a owerful Viatel terminal and permits storage of screens on disc later reference, hardcopy printing and easy auto log-on of atel identity.

TELESOFTWARE DOWNLOAD. A vast software library only hone call away. Download programs from Microtex 666 when u need them and store permanently. Telesoftware download cility guaranteed compatible with Microtex 666 and conforms Telecom's Viatel Telesoftware specifications.

MICROTEX 666 SUBSCRIPTION. Nothing more to pay... ur package includes a year's subscription, normally priced at 9.95. Microtex 666 – the Service Provider on Viatel dedicated tirely to personal computer enthusiasts. Choose from ndreds of programs from the Telesoftware library.

FULL INSTRUCTION BOOKLET. As easy as making a phone ll. Comprehensive manual and simple on-screen instructions ow easy Viatel access.

✻ **COMMODORE 64:** ✻ Disc or Tape Software ✻ Modem connects directly to user port ✻ Text and graphics print facilities ✻ User defined command keys ✻ Access to Club 64 – $100 of Free software. **APPLE II** ✻ Monochrome or full colour if colour card installed ✻ Requires standard serial interface. **IBM** ✻ At last a low cost Videotex and communications solution ✻ Uses standard IBM colour/graphics adaptor ✻ Requires standard IBM serial port ✻ Simple help menu to select all functions ✻ Software displays full graphics in limited colour or restricted graphics in full colour. Optional character chip allows full graphics in full colour. **BBC MICRO** ✻ A complete communications package for BBC micros ✻ Software supplied in ROM chip ✻ Full Viatel colour and graphics ✻ Communications facilities for bulletin boards and other information services.

✻ **AUSTRALIAN MANUFACTURED.** All components designed and manufactured in Australia for compatibility with Viatel. Available from **Information Solutions** – sole distributors for Microtex 666 Viatel packages.

☐ Commodore 64 *(disk or tape version)*	$399 inc. tax
☐ IBM PC and Compatibles	$499 inc. tax
☐ Optional IBM PC character chip	$80 inc. tax
☐ Apple II	$499 inc. tax
☐ BBC Micro	$499 inc. tax

☐ **Enclosed is my cheque or money order made payable to Information Solutions for $** .....

☐ **Please debit my credit card.**

Account Number **Expiry Date** /

Signature .....

All major credit cards and Bankcard accepted.

Name .....

Address .....

..... Postcode .....

Please send this Order Form with your remittance to:
Information Solutions, 31 Victoria Street, P.O. Box 174, Fitzroy. Victoria 3065. IS 294R

Save time. Phone instead.

To order or for more information simply phone **(03) 419 0300.**

Dealer enquiries welcomed.

fit your particular TV or monitor; start-up graphics mode; disabling of boot load on pressing Shift Break; disk drive select (5¼in, 3½in, 3in and Winchester); and Default filing system (CFS, RFS, DFS or ADFS). As they are in a separate area of battery-backed RAM, these options are retained even when the machine is switched off.

There is no real difference between the system software for the MS-Turbo and the MS-ET from the MS-128. The MS-512, however, needs an operating system for its 80186 operation, and for this Acorn has chosen Digital Research's DOS+ which gives supposed compatibility with both the MS-DOS 2.1 and CP/M 86 business operating systems. DOS+ is *not* IBM PC-compatible, but it should be able to run generic MS-DOS applications such as WordStar that do not rely on specific IBM-like hardware. The MS-512 is also bundled with the GEM friendly user interface and the applications of the GEM collection. The MS-Scientific runs the PANOS operating system in line with its program development roots, and this makes it compatible with the Cambridge Workstation from Acorn.

Applications software

As you would hope for any machine that is so similar to the BBC Model B, the Master Series range is compatible with Model B software. The official blurb says that Model B software will run with little or no modification on the Master Series, but the big question is: how much commercial software will need that little modification, as users can hardly be expected to perform it themselves?

My limited experiments suggest that about 90 per cent of existing software runs without problems, but only 60 per cent of disk-based software ran with no trouble. Acorn says that my figures are somewhat pessimistic but, whatever the truth, I suggest that before upgrading from a Model B, you check that your most important applications run satisfactorily. For people considering the purchase of an MS-128 as their first micro there isn't much to worry about, as I'm sure third-party software producers will quickly modify their programs to run on both systems. Barson Computers, the Australian distributor, could help in the transition period by publishing a list of incompatible software.

Five applications are included in the machine's 128k ROM: BBC Basic Version 4.0; EDIT, a program and text editing program; the VIEW Version 3.0 word processor; the Viewsheet spreadsheet; and a terminal emulation program.

BBC Basic is widely regarded as the best Basic available. It is two years since I've done anything serious with BBC Basic, but at the time I did agree that it was the best on any micro. In those two years, rival manufacturers have added to their Basics many of the features that set BBC Basic apart from the competition. It took half an hour with BBC Basic to convince me that it's still the best; its structuring facilities and procedure definition facilities have yet to be matched, and, what's more, it's fast.

Version 4.0 of BBC Basic is compatible with earlier versions, but also incorporates some of the features of the new operating system, particularly in the area of graphics. The original BBC had eight graphics modes with resolutions of between 20 x 32 and 640 x 256. The MS-128 has eight additional modes, 128 to 137, which behave in exactly the same way as the original modes but consume none of the 32k user memory. The screen data in these modes is stored in the shadow memory. Existing BBC users who have seen practically all their usable memory gobbled up by a hi-res screen may find this reason enough for the purchase of an MS-128, and the scope for applications is vast.

The other command that has been expanded on Version 4.0 of BBC Basic is Plot, whose functions now include circle outline, circle fill, circular arc, parallelogram fill and rectangle fill, to name but a few.

View and Viewsheet were previously available as ROM software for the Model B. Both programs are competent efforts, and include most of the features found on their more expensive business competitors. Having these bundled with the MS-128 will make more users realise the usefulness of the two most common business applications — the spreadsheet and the word processor. Teachers in particular will be able to demonstrate to their pupils the applications they will probably use in the future.

The remaining two programs, Edit and the terminal emulation software, are useful but not particularly exciting. Both programs are of the type that are often required in addition to a commercial piece of software or hardware.

Documentation

I suppose I've been spoilt by previous Acorn documentation, but I was disappointed with the MS-128's *Welcome Guide*. A further three technical manuals are available from Barson Computers at extra cost.

Technical specifications

Processor:	65C12 running at 2MHz
ROM:	128k
RAM:	128k
Mass storage:	N/A
Keyboard:	93-key full-stroke, including numeric keypad
Size:	18ins x 17ins x 4ins
Weight:	13lbs
I/O:	Two cartridge sockets, disk interface, Econet socket, parallel printer interface, serial RS432 interface, user port, 1MHz bus, tube, analogue in, RGB, composite video, TV and cassette.

In perspective

The Master Series 128 is in the serious hobby/small business area of the market, and as such is not without competition. The Amstrad 6128 offers a colour monitor and a disk drive at nearly $200 less than the base-model 128; it also runs CP/M Plus, opening up a wealth of business software. True, the 6128 cannot offer anything near the same expansion facilities as the MS-128, but is this feature worth all that extra cost?

More up-to-date in terms of technology is the Atari 520ST which offers a 16-bit processor, 512k of RAM and a friendly Mac-like interface in an all-in package, with monitor and disk drive for $2500. The ST has nothing like the established software base of the BBC, however. And it must be pointed out that the base price of the MS-128 is significantly below the current price of the BBC B+ with DOS, making it a much more serious contender to the Apple IIe on a value for money comparison.

It is in the area of education that the MS-128 has least competition. I sense a movement towards 16-bit-like business machines, but Barson also has a very competitive entry in the field — the MS-512.

SOUTH PACIFIC COMPUTERS PTY LTD

is proud to present

LOGiSTiX by GRAFOX

ADDS TO THE SPREADSHEET WHAT YOU REALLY NEED

TIME MANAGEMENT

The Logistix worksheet provides the four facilities required by the professional microcomputer user: a powerful spreadsheet, extensive database facilities, presentation quality graphics and that vital fourth dimension — Time Management.

Vital because Logistix lets you plan any aspect of your business; the assignment of staff to tasks, the allocation of jobs to machines or even the scheduling of a full scale project using Critical Path Analysis.

Only Logistix integrates Time Management with classic spreadsheet features, an easy-to-use database and unparalleled graphics.

Logistix even reads data files from other popular spreadsheet and database packages.

Logistix: the best idea in business software since the Spreadsheet.

- TIMESHEET
- SPREADSHEET
- GRAPHICS
- DATABASE

SOUTH PACIFIC COMPUTERS

No. 3/417 FERNTREE GULLY ROAD,
MOUNT WAVERLEY, VIC. 3149.
TELEPHONE: (03) 543 4477

COME AND SEE US AT PC '86 — CENTRE POINT SYDNEY MARCH 12, 15

Prices

The prices for the Master Series are as follows: the MS-128 will retail for $1386 (including sales tax); the MS-ET for around $1050; the MS-Turbo will sell for $1792; the MS-512 will cost exactly double the MS-128 at $2772; while the price of the MS-Scientific is not yet available, but should be around $5700.

The MS-128 and the MS-Turbo should be available by the time you read this; the MS-512 at the end of March; the MS-ET in April; and the MS-Scientific sometime in the second quarter of this year.

Conclusion

The MS-128 continues the Model B's tradition as a 'good all-rounder' in all areas bar one — price. At just under $1400 it represents good value when compared with previous BBC machines but not, sadly, when compared with the competition. The machine has sufficient features to be of interest to schools and educational establishments, to existing BBC users and new users, and I expect it to maintain Acorn's position as one of the leaders in this field. I don't expect it to produce a rush of new home users purely due to the price. If Acorn had bundled in a good-quality disk drive, then the picture might have been different. It's possibly the best 8 bit micro available, but it's far too expensive.

I won't comment on the other machines in the range until I've seen them, but one thought did strike me. The MS-512 looks like being a very interesting machine — but what a shame it isn't IBM-compatible. I realise the technicalities involved in such a machine's production, but a $2,500 micro that is both IBM and BBC compatible would really be something to be reckoned with.

END

'It says it's pregnant.'

PC's & MINIS ARE DEAD!

Now some facts about the Archives MicroFive

STANDALONE CONFIGURATIONS

1. Twice the performance of an equivalent IBM AT system for less cost (see PC Week review and MicroFive tests)

TIMESHARE CONFIGURATIONS

2. Combined with Kimtron KT7/PC terminals and the Xenix operating system, the Archives MicroFive delivers more power than top range superminis (see BYTE benchmark), at a fraction of the costs: 1-16 users available.

BUS NETWORK CONFIGURATIONS

3. Power each KT7/PC user workstation with its own IMByte PC Slave processor (which plugs into the MicroFive expansion bus), and dedicate the central system to multi-user system management. The high speed bus networking coupled with the MicroFive's powerful multi-processing architecture makes this configuration one of the fastest available (see our benchmarks). 1-8 users can be guaranteed and up to 31 with expansion chasis.

LOCAL AREA NETWORK CONFIGURATION

4. Other PCs or standalone MicroFive systems can be connected to the Archives MicroFive as the central server in a local area network (LAN). Novelle Corporation has endorsed the MicroFive as their top line 286 server offering 1-50 users in the highest performing L.A.N. available (see Novelle test results). Many other LANs are also fully compatible with the Archives MicroFive.

NOW CALL US

5. Archives is the only authorised Australian distributor of the MicroFive range of systems, and we are looking for dealers, OEMs, and VARs. And, we have an extensive range of multi-user software and peripherals that will run under a whole host of configurations.

archives

Preferred Supplier to the Federal Government

• Melbourne	(03) 699 8377
• Sydney	(02) 922 3188
• Canberra	(062) 476 555
• Auckland	(9) 503 548

The Multiuser Specialists

SCREENTEST

At your service

Antony Ginn operates a walking, talking machine, using Forth and Logo as robot-controlled languages.

The home micro and the home robot make the ideal couple. The computer supplies the brain and the robot supplies the muscle — and a programming control language unites the two. The growing popularity of robots, and the understanding that a robot, no matter how sophisticated, is as limited as its programmability, has prompted several recent developments in these control languages.

Many observers have compared the state of home robotics to that of home computing five or six years ago. There is a 'back-shed pioneering spirit' with a sense of rapidly growing interest. Turtles, buggies and robot arms are becoming common, and the price of robots has fallen to within reach of the home user. Some of the larger toy companies have also sensed the wind and invested in the home robotics/toy market. For example, Lego and Milton Bradley have both produced respectable robotic toys in the past year. There is no shortage of hardware, but the accompanying software is of varying quality, sometimes leaving users to struggle with machine code rather than offering easier-to-master methods of control.

The only method of programming the most sophisticated personal robot on the market, Hero 2, is with 6800 machine language. The programming section of the Hero ET-18 technical manual recommends you go away and study 6800 machine code before attempting to control the robot — hardly state-of-the-art user friendliness.

Hero contains its own onboard computer, which has a keypad and a one-line digital display. A typical program (taken from the manual) using monitor subroutines REDIS and OUTCH is shown in Fig 1.

Looking in detail at the first two lines, 0600 is the instruction address, usually called the 'program counter'. In order to execute a command, the program counter must contain this address. BD-F64E is the instruction, normally one, two or three bytes of data. It indicates, in hexadecimal machine code, the operation to be performed. START is the label of a subroutine (the address to be entered to begin execution) used more than once in the program. JSR is a three-letter mnemonic, indicating the source instruction. REDIS is the mnemonic operand, supplying additional information required for the operation, a label, an address or data.

'Forth is a compiled language, and because it generates machine code, it is much faster than interpreted languages such as Logo and Basic.'

The second line begins with the instruction address, followed by the machine code instruction 86 and the operand 01. The mnemonic LDDA contains four letters; the fourth A is added to indicate which of two accumulators the instruction applies to. The # in the last section indicates that the immediate addressing opcode is to be used, and the $ indicates that the information is a hex value. If you find this confusing, don't worry. Most robot manufacturers have realised that their market will increase if they make their products available to non machine code programmers.

The simplest programming method is to manually move the robot, and let the computer record and replay the movements. So-called 'first generation' robots in industry, used for large batch-repetitive tasks, are often programmed in this way, and several home robots also have this 'learn by example' facility.

The Beasty robot arm may be taken manually through a routine, using control keys in the immediate mode. The arm is moved to a particular location, lifts something and puts it down elsewhere. The computer records each motor's movement and is able to replay the sequence indefinitely. As another example, the Omnibot from Dick Smith Electronics carries a cassette recorder — putting it on RECORD and moving the Omnibot around the floor with the handheld remote-control joystick will record the movements. The robot may then be programmed to execute the routine at any time. It is also possible to record human speech in the program, through a microphone in the control unit. It is capable of wheeling in a glass of orange juice and singing 'Oh, What a Beautiful Morning' at 6am every day.

Unfortunately, a robot programmed in this way has no way of knowing if an object it is to lift is in the correct position, or if there is an obstacle in its path. It will move to the same place whether the object is there or not, and is unable to cope with any environmental change. The Omnibot could easily bump into your slippers, tip the orange juice over your duvet and sing to the cat, without knowing anything was amiss.

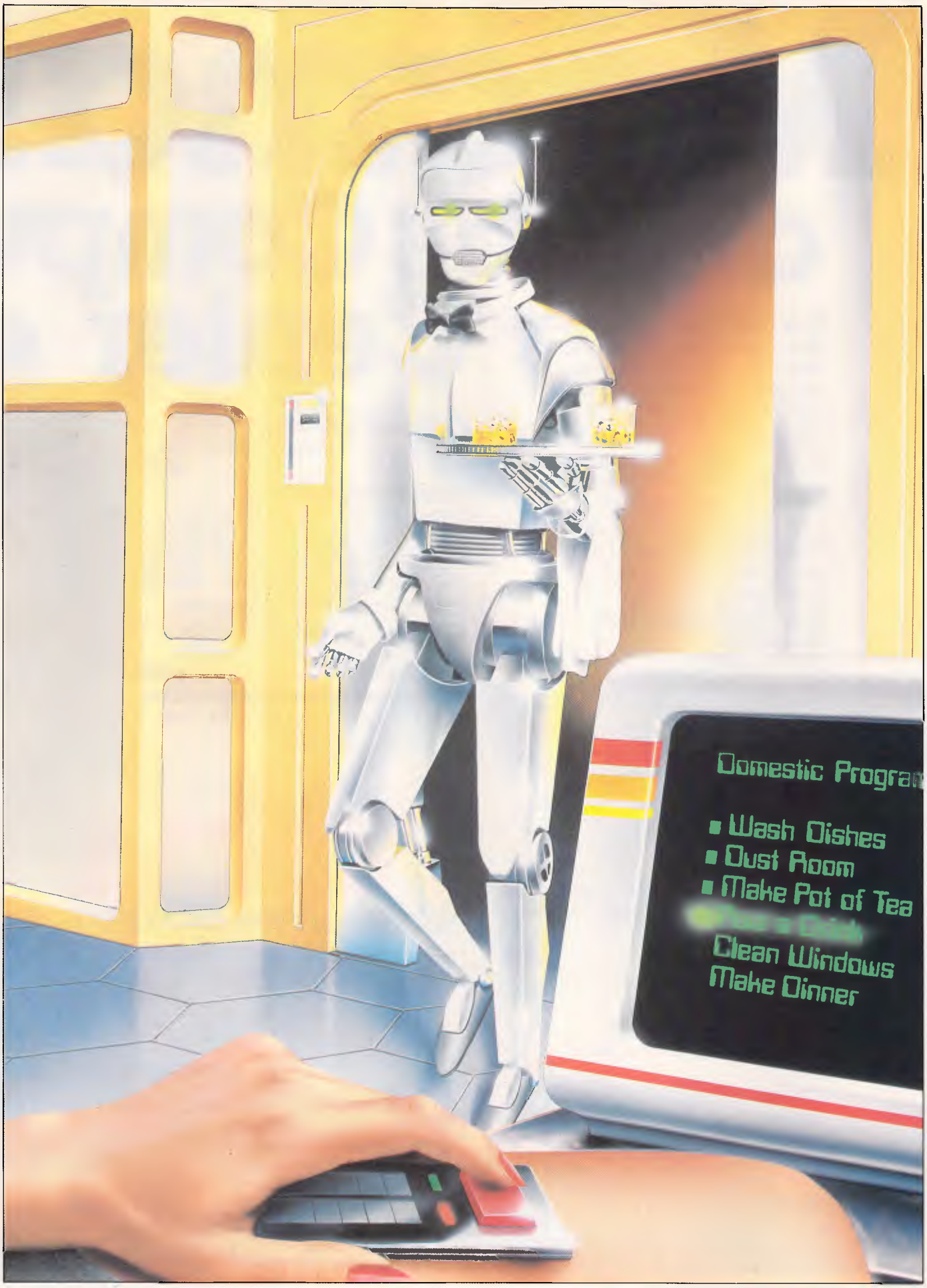


Illustration by ***Stuart McKay***

Macmar
at Rob's Compu
Center

Authorised Dealer

New Mac Plus – twice the Mac
New Macintosh Plus gives you twice the memory (1 megabyte), twice the disk storage (800k), twice the speed, a new larger keyboard, and industry standard S.C.S.I. ports so you can expand your Macintosh Plus like never before. All this for $4495. Only $100 more than the old 512k Macintosh. Phone now and we will give you a free box of Diskettes worth $95.

Save $1445 on the 512k Macintosh
The Fat Mac must make way for the new Macintosh Plus.
512k Macintosh was $4395 but it can now be yours for only $2950 while stocks last. Hurry.

Macintosh Plus upgrade
If you're lucky enough to own a Macintosh already then don't miss out on the new Mac Plus features. We can give you an Authorised Apple Macintosh Plus Upgrade. It's just like getting a new computer.

Diskdrive upgrade **$695**
Exchange internal drive for new 800k drive.

Logic board upgrade
512k to 1 megabyte Mac Plus board **$1345**
128k to 1 megabyte Mac Plus board **$1845**

Keyboard upgrade
Swap your old keyboard for the new one **$275**

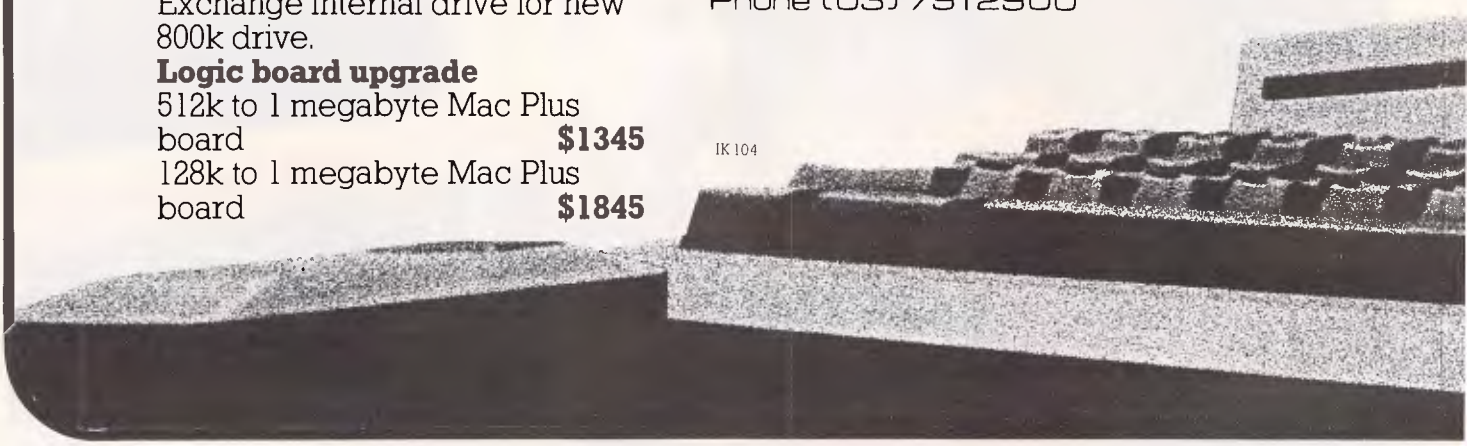
Complete upgrade
Upgrade your drive, logic board & keyboard at once and save $165!
For Macintosh 512k units **$2150**
For Macintosh 128k units **$2650**

800k external drive upgrade
Change your 400k single side drive for the new 800k double side drive **$495**

Phone now for more information
Don't delay phone (03) 791 2900 for more specials.

rob's
COMPUTER CENTER
295 Thomas Street, Dandenong 3175
Phone (03) 7912900

IK 104



nia
ter

For more sophisticated control of robots, a formal programming language is required. 'Second generation' industrial robots are designed to work in more varied environments and are used for small batch work. They must be switched between tasks, and be able to adapt to a new environment, without requiring extensive reprogramming. Developments in home robotics have followed a similar trend: sensors, and the software to support them, are increasingly common, enabling turtles and buggies to interact with their environment. The Buggy has a light sensor, touch detectors and a bar code reader. The Snap EV1 vision system comes with software to teach object recognition and detect movement, mimicking industrial robot vision systems. Advances in robotics have prompted development and extension of languages such as Forth and Logo for control purposes.

Forth

Forth is a stack-oriented language, which makes it fast and flexible. It is procedural, and allows you to create a dictionary of your own primitives or alter the definition of existing primitives. Forth is a compiled language, and because it generates machine code, it is much faster than interpreted languages such as Logo and Basic. The lower levels of Forth don't require an operating system speaking directly to a port or memory bit, and the easy access Forth gives to hardware and peripherals has made it popular among roboticists. The world's best-selling industrial robot, Unimation's Puma, is programmed in Forth.

Forth uses Reverse Polish notation (instead of 1 + 2, we write 1 2 +). Programs are written in groups of words, defined by the programmer. At the bottom level, machine language primitives drive the robot's motors. The syntax is difficult, and only when a dictionary of Forth words has been created does it begin to look comprehensible. For example, a procedure written to put data for a buggy's driver motors onto the corresponding channels of the output port would be defined in such a way as to describe the task. PC could turn the Port motor Clockwise; PA would turn it Anticlockwise. Each channel would be defined as an address and given a name, and signals sent to that address would go to the appropriate motor in the buggy and turn it in the desired direction.

Colne Robotics has recently released Colneforth, a Forth package for its Armdroid robot arm. It has avoided the difficulty of having to build procedures with Forth primitives by extending Forth's usual 150-word vocabulary by another 80 words, with specific robotic functions. Before using the robot, it is necessary to program the output port, initialise the acceleration profile and motor phase patterns, set the starting positions and speeds of the motors, deselect any joints that are waiting for a specific instruction, and select the sense of all joints to GLOBAL. All these instructions have been defined in a Colneforth procedure called START: typing START will tell the computer to carry out the above functions. Many new words are for programming specific joints of the arm. ELBOW selects the elbow for commands, WRIST selects the wrist, and MOVE, followed by a numeric input, moves a selected joint a specific amount.

TELL ELBOW MOVE 50 moves the elbow stepper motor through 50 steps.

TWIST is a command specifically for the wrist. It also requires a numeric input. To twist the wrist, one motor must turn clockwise, another anticlockwise.

TWIST 50 turns the right motor forward 50 steps and the left motor back 50 steps, causing the wrist to twist.

TILT also talks only to the wrist and requires an input. It will tilt the wrist by the given input.

When a move is complete, the computer shows the position of each motor. Six columns, headed BAS (base), SHO (shoulder), ELB (elbow), RIG (right), LEF (left) and GRI (grip) will display a three-digit number. The numbers represent the current coordinates of the arm. If the coordinates scroll off the screen, they may be relisted with WHERE.

If the base is at position 100, typing TELL BASE MOVE 100 will move the base motor 100 steps and change the coordinate beneath BAS to 200; MOVETO 100 will return it to its previous position. MOVE is a relative command, and it is possible to talk to more than one joint simultaneously.

TELL ELBOW SHOULDER MOVE 100 will move both elbow and shoulder through 100 steps.

Any arm position may be labelled and used in a Forth procedure.

PLACE tells the computer you are about to name the arm's position.

PLACE CLIFTON will record the current coordinates under CLIFTON. Typing GOTO CLIFTON when the arm is in another position will cause it to return to those coordinates.

Another location could be labelled BULWELL, and a procedure defined to send the arm on a 'journey' from CLIFTON to BULWELL. A new word is defined with the Forth command : at the start, followed by the word, its definition, and ; at the end.

```
:JOURNEY CLIFTON BULWELL;
```

Typing JOURNEY will move the arm first to CLIFTON, then to BULWELL. The value of the gripper's position may be held in a variable, allowing different 'objects' to be defined in terms of the gripper position. The arm may then be instructed to go to a place and pick up a particular object.

If the robot is to interact with the environment, for example to wait for an object to be positioned during a journey, it is necessary to define a procedure at Forth's bottom level. HANGON will tell the arm to wait before picking up an object. Whatever value is at the port location FD00 is placed on the stack as an eight-bit number. BEGIN and UNTIL are the parameters of a loop which repeats until the value in the address C@ corresponds to the 1 before the logical AND.

```
: HANGON BEGIN [HEX] FD00 C@ 1
  AND UNTIL ;
*LEARN HANGON
```

We may create a Forth word to miss three lines if the object is not present:

```
: SKIP [HEX] FD00 C@ 1 AND IF 3
  LINE# +! THEN ;
```

Forth will allow another procedure to be executed at any stage during a journey. This could be another route, or a word such as GET PLACE or PUT.

The arm may be programmed to move until a particular event takes place, such as finding an object of unknown location. A light beam on the arm could be interrupted when the arm reaches the object. The criterion for the search is programmed in Forth. A word is defined to leave a 'true' when the search is finished, represented by the value of 1 produced by the light beam on port FD02 changing to 0 when interrupted.

```
: FOUND FD02 AND 0= ;
```

This reads a byte from port address FD02 rather than FD01 and tests bit 2 rather than bit 1.0= changes a 0 to a 1. If the value coming out of that bit is not a 0, then 0= will leave a 0. True is represented by 1. If this is the value on the stack,

```
0600 BDF64E  START  JSR REDIS        Set up first display address
0603 8601           LDA A #$01       First segment code
0605 2009           BRA OUT
0607 F60FF3  SAME   LDA B,DIGAGG+1   Fix display address
060A CB10           ADD B #$10       For next segment
```

Fig 1 A typical program using REDIS and OUTCH

"The COMPAQ Idea." Where to be inspired.

"The COMPAQ Idea."

In 1982 COMPAQ decided to produce an "Idea."

Not a PC compromise.

"The COMPAQ Idea" was simple.

COMPAQ would not compromise on the quality of their product. **COMPAQ would give people PC's and a selected dealer network that "simply work better."**

And now COMPAQ are Number 1 world-wide in sales of full-function portable PC's to the business market.*

In Australia the company intends to continue this success by offering people a range of personal computers that simply work better, through selected dealers that simply work better. Better informed, better after sales service, better technical support, better training facilities.

Dealers who, like COMPAQ PC's, are significantly better than the market standard.

At our Authorised Dealers, expert guidance will assist you in choosing a PC exactly suited to your needs, from an entry level Portable, to the exceptional power and speed of the COMPAQ 286 series; portable or desktop.

A range of rugged and powerful PC's that utilise advanced technology which simply puts them in a class of their own.

COMPAQ monitors display both high resolution text and graphics – not one or the other.

Our integrated tape back-up can protect Megabytes of data in minutes instead of hours. Our disk drives are protected by shock absorbing mounts for the utmost in rugged reliability.

Our unparalleled expandability means your COMPAQ can grow as your needs grow.

And as for compatibility, COMPAQ computers run the largest library of business software in the world.

In short, with COMPAQ Computers and Authorised Dealers, you get products and services that simply work better. You don't get compromises.

When you're ready to inspire your business with "The COMPAQ Idea," ring for the location of your nearest Authorised Dealership.

• **B.S. Microcomp Pty Ltd:** Victoria (03) 614 1433. N.S.W. (02) 27 1122 • **Communications and Peripherals Australia:** Victoria, N.S.W., S.A., W.A. (03) 544 3444 • **ComputerLand:** N.S.W., call toll free (008) 22 6852. Victoria, call toll free (008) 22 6852. Queensland, call toll free (008) 22 6852. Western Australia (09) 322 7188. South Australia (08) 212 7191 • **The Computer Shop:** Darwin (089) 81 5022 • **Australia Entre Business Centres Pty Ltd:** (03) 529 7599 • **Hisoft Computers Pty Ltd:** Victoria (03) 529 2333. N.S.W. (02) 267 9944. S.A. (08) 332 1688 • **O'Reilly Computer Pty Ltd:** Offices in all main land states. Head Office (02) 692 8688. • **The Computer Group Pty Ltd:** Victoria, W.A., N.S.W. (02) 736 3211 • **Myer Computer and Business Centre:** Victoria (03) 661 3342. S.A. (08) 217 0123. Queensland (07) 378 5111. W.A. (09) 321 0151.

COMPAQ

SIMPLY WORKS BETTER

Ogilvy MCQ0023 *SOURCE: DATAMATION MAGAZINE.

the search stops. The search is executed after every step of the motor. When the value changes, the robot decelerates and backs up. SET-CRITERION, an extra Colneforth primitive, followed by a word, sets that word to be the criterion for ending a search. The word must leave true or false on the stack. SETCRITERION FOUND sets the criterion. A search will be ended when the beam is broken and the value on port FD02 changes from 1 to 0.

Logo

Forth is powerful, fast and difficult. Logo is another procedural language, powerful, not so fast and not so difficult. One of Logo's original functions was to control a robot turtle. The turtle is becoming a familiar sight in schools, leaving an inky trail as it trundles across the floor drawing polygons and knocking down cardboard towers. Six Logo primitives drive it FORWARD or BACK, turn it LEFT or RIGHT, PENUP and PENDOWN raise and lower its pen. FORWARD, BACK, LEFT and RIGHT all require inputs; these are used to define turtle graphics procedures. Procedures are built up similarly to Forth. Routines for the various parts of a house are defined using simple FORWARD, BACK, RIGHT, LEFT, PENUP and PENDOWN commands, and are then combined in a procedure called HOUSE:

```
TO HOUSE
WALL
ROOF
DOOR
WINDOW
END
```

The appearance of a variety of low-cost robotic devices, such as the Beasty arm, Fischer Technik kits and Milton Bradley's new Robotix kits, has prompted developments to Logo, which is the only accessible means for children, and most adults, to have powerful computer control without struggling with difficult syntax.

Anyone who is familiar with writing turtle graphics procedures will have no difficulty writing procedures for a robot. The control primitives allow individual servos to be addressed and their angles specified. Many Logos have multiple, redefinable screen turtles known as 'sprites', which are addressed using TELL, TELL 2 FORWARD 120, for example. A robot's motors may be addressed in the same way. The Beasty robot arm is controlled by three or four servo motors which are assigned a number dependent on which port channel they are driven from, with MAKE. The gripper, driven by servo 1, can be closed with:

```
TELL 1 SETANGLE 5
```

This could be written into a procedure:

```
TO CLOSE
TELL 1 SETANGLE 5
END
```

Logo allows several small routines to be combined to form an involved procedure. Seymour Papert, one of Logo's architects, calls this 'Dealing with a problem in mind-sized bytes'. A procedure for the arm to pick up, move and put down an object would be written in small parts and combined in a final procedure.

Each servo rotates an output arm though 100°. In the example, servo 1 will control the gripper, servo 2 the forearm, servo 3 the upper arm, and servo 4 will rotate the arm in a horizontal plane.

We will use CLOSE in the definition, and define OPEN in a similar way:

```
TO OPEN
TELL 1 SETANGLE 100
END
```

The arm is rotated, in line with the object, with POS1:

```
TO POS1
TELL 4 SETANGLE 80
END
```

The object will be lowered at POS2, the equivalent of 20° on the setting of servo 4. Moving the arm directly from the keyboard, in the immediate mode, displays the current setting for each servo. Values included in the program are ascertained by moving the arm manually and noting the reading:

```
TO POS2
TELL 4 SETANGLE 20
END
```

Two positions for the forearm are defined. It is lowered to pick up the object and raised to carry it:

```
TO LOWFOR
TELL 2 SETANGLE 20
END

TO RAISFOR
TELL 2 SETANGLE 90
END
```

Similar procedures are written for the upper arm:

```
TO LOWUP
TELL 3 SETANGLE 40
END

TO RAISUP
TELL 3 SETANGLE 75
END
```

The above procedures are then combined in routines to lift, carry and lower an object:

```
TO GRAB
OPEN
POS1
LOWFOR
LOWUP
CLOSE
END

TO MOVE
RAISFOR
RAISUP
POS2
END

TO LOWER
LOWFOR
LOWUP
OPEN
END
```

These three procedures are combined in GETOB:

```
TO GETOB
GRAB
MOVE
LOWER
END
```

GETOB may then be used to build another procedure.

Writing the above program in Basic would involve dozens of subroutines and difficult syntax, making it incomprehensible to most users.

Conclusion

There was no great need for speed in the original versions of Logo. With the introduction of sprites, multiple turtles with speed and heading, and Logo's control application, work is under way to develop faster versions. Express Logo, several times faster than existing Logos, has been written for use in French schools. Work is also in progress to write a version of Logo which uses the stack in a similar manner to Forth, which will greatly increase its speed. Applied Technology is offering a Logo language for its MicroBee which can be both interpreted and compiled (for ease of development and faster execution speed, respectively).

Paul Cheung, of Edinburgh University's Artificial Intelligence Department in the UK, has written an educational control language called Concurrent Logo. It allows parallel processing of up to eight procedures, and contains extra primitives such as WHENEVER.

Other control languages have been developed for specific robots, but they are often written in Basic which makes them slow and limited. Savvy, a language developed in the US to control the RB5X personal robot, is a 'plain language system' with an extendable robot control language (RCL). It compiles RCL words into Tiny Basic code.

The trend in control languages is towards power, speed and friendliness. The days of trying to learn machine code before you can move your buggy across the carpet are over. END

IPX XT - IPX AT

These IBM compatible computers are the best quality machines in Australia. Over two years on the market with a return rate of less than .5% and being highly compatible, you could not have a better computer.

Special Features

Case — the case is solid and sturdy, approved by FCC for minimum EMI.
Magic Card — one card that supports RGB hi-res color, hi-res mono, and composite monitors which solves the problems of card changing.

Reset Button — apart from being convenient, this protects the power supply from the problems known with other computers.

Quality

Components — the components are 40% above the required rating, minimizing aging ailments.
Workmanship — each computer is manufactured using the most modern techniques and automatic equipment.

Tests — each computer is subject to seven cycles of thermal shocks (as specified by NASA) which puts the computer under harsh conditions prior to shipment and ensures 'weaklings' are not shipped.

Local Production

Beginning in April this year, IPEX will assemble the IPX 8088 XT (8 configuration) and IPX 286 AT (10 configuration) in Australia.

IPX IPX 8088 XT

- 2 x 360 KB TEAC F/D
- 640 KB - RAM
- Ports - Serial, Parallel, Game
- Power Supply - 240V, 135W
- Ergonomic Keyboard
- Case - FCC Approved
- Magic Video Card (R.G.B., Mono Video, Composite)
- Reset Button - in front
- Manuals - MS DOS 2.11

Select from the Following:
10MB, 20MB, 30MB plus Back-up Tape 60MB.

Compatible with software that runs on IBM XT.

IPX IPX 286 AT

- 2 x 1.2MB TEAC F/D (Alt. 1 x 1.2 MB, 1 x 360KB)
- RAM - 512, 640, 1024 KB on M/B (Expand to 14MB)
- Ports - Parallel, Serial
- Power Supply - 240V, 200W
- Keyboard - IBM AT style
- Case - FCC approved with Key Lock
- Magic Video Card
- Reset Button
- Runs 33% faster than IBM AT
- Manuals - MS DOS 3.1

Select Hard Disks - 20MB, 30MB, 40MB, 70MB, 120MB plus Back-up Tape.

Compatible with software that runs on IBM AT.

Next to Come - IPX 8088 Turbo.
Switchable 4.77/8MHz - The answer to speed/compatibility clash.

IPX

IPEX COMPUTER (WHOLESALE)

70 STEPHENSON STREET,
RICHMOND, VICTORIA, 3121
TELEPHONE: (03) 429 1288 (6 LINES)

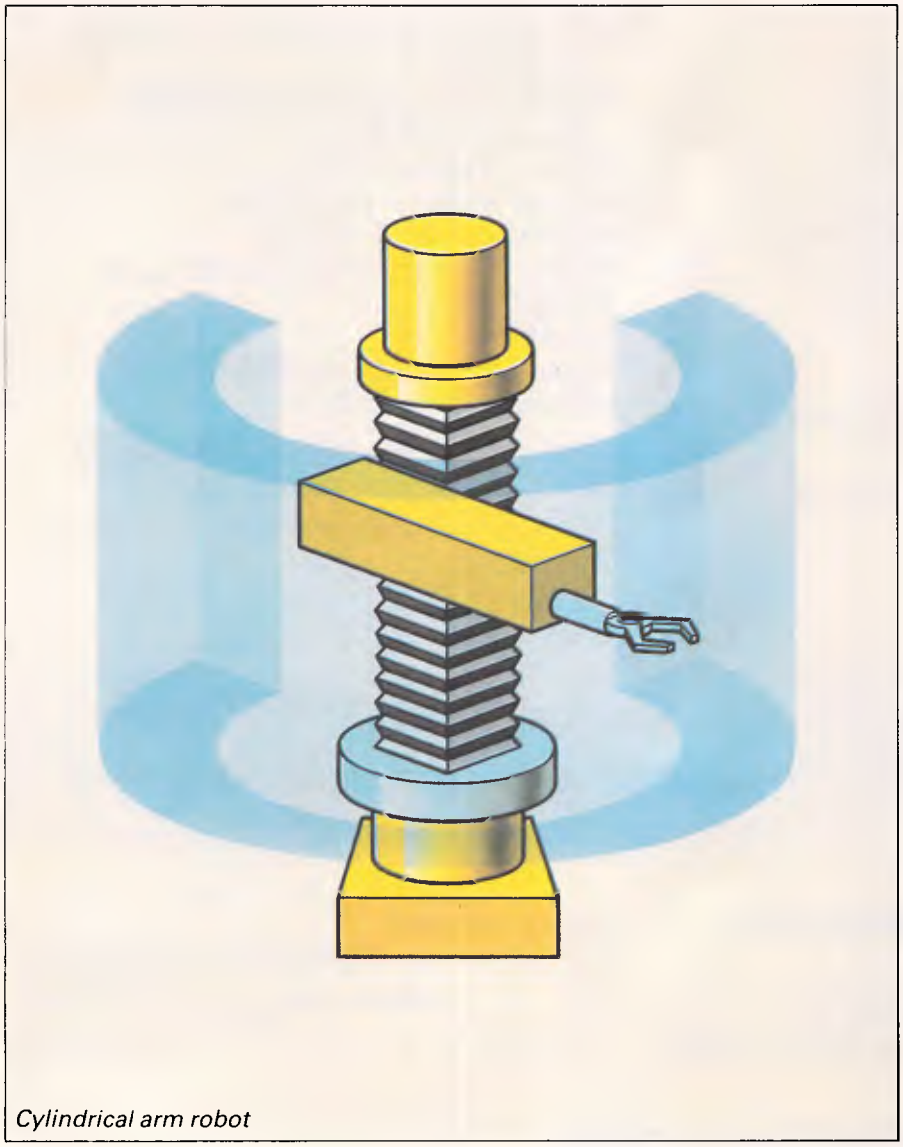
DEALER ENQUIRIES

N.S.W.	(02) 646 4011 (Ask for Geoff Koo)
QLD.	(02) 646 4011
S.A.	(08) 339 3952 (Ask for Chris or Robert)
TAS.	(002) 48 7444 (Ask for Jo)
W.A. & A.C.T.	(03) 429 1288

5 Million Hours of Fault Free Operation

A sense of awareness?

Robots have a long way to go before they conquer the world — for a start they can't 'see' where they're going. But progress is being made in this direction, as Graham Storr reveals.



Cylindrical arm robot

You may have read recently, not in a science fiction novel but in a newspaper, about a court case involving a restaurant that bought a robot to serve its customers. The robot (allegedly) began behaving erratically, moving jerkily, spilling drinks and, finally, ran amok, barging into things until its head fell off into a customer's lap!

Like it or lump it, the Robot Age has arrived.

As this unfortunate incident suggests, it will be a long time before rebots are practical realities in shops and restaurants; however, they are finding their way into more and more factories, warehouses, and even homes.

While we may be on the verge of the fifth generation of computers, we are only just ending the first generation of robots. First generation robots are programmable machines with little or no sensory ability or intelligence. The prime example of such a device is the robot 'arm' used in factory environments such as the car assembly line. There are a huge variety of arms in common use. They can be distinguished by their power source (electric motors, hydraulics or pneumatics) and by their 'working envelope'.

The envelope of a robot is the surrounding volume of space which it can reach with its 'end effector' (its gripper, welding torch, paint spray, or other tool). The shape of the envelope is determined by the physical construction of the arm. An arm that rotates about and moves up and down on a central pillar, which can move its 'hand' in and out from the pillar, would be able to reach a cylindrical space around the pillar: such a robot is known as a cylindrical robot. Different mechani-

cal linkages lead to spherical, snake, jointed-arm and other kinds of robots and envelopes. The number of axes of movement of the arm — its 'degrees' of freedom — determines its flexibiity of movement within its envelope. The kind of jointed-arm robot that can reach inside a car body and tighten screws under the dashboard may need to have rotations at its base, shoulder and elbow as well as pitch, roll and yaw movements at its wrist.

Generally, the more degrees of freedom a robot arm has, the better it is at performing a wide variety of tasks — but the more expensive it becomes to manufacture and the harder it becomes to control.

Instruction

Modern factory robots perform tedious routines, repeating a limited number of sequences of movements over and over again. The problems for the robot programmer are to give the robot the sequences in the first place and then to ensure that they are obeyed in close synchronisation with the other machinery involved (such as conveyor belts, part feeders and other robots). Above all, accuracy must be maintained.

There are several common methods of instructing a robot, one of which is leading it through the motions. This is especially useful for highly skilled and complex tasks like paint spraying. The robot, in teach mode, is physically moved through the sequence while its controlling computer samples the values of potentiometers in its joints. This in turn yields a mass of data which is stored away for later use. To 'play back' the movements, the computer needs to unwind this stream of data, generating the control signals that will move each joint to the position stored in memory. The sheer volume of data and the speed at which actions must be taken means that dedicated minicomputers are often required.

Another method is for a human operator, equipped with a keypad known as a teach pendant, to operate the robot's motors by moving the arm to particular positions which it needs to reach during its task, and then telling the computer to store these. Because very few points along the path are indicated, very little data needs to be stored. However, on a playback, the computer must compute a trajectory for the arm which will take it from point to point, accelerating and decelerating the various joints so that the end effector quickly reaches its working positions. Obviously the more joints that are involved in this calculation, the trickier it becomes.

Jointed arm robot

A far less common but increasingly popular way of controlling robots is through special, robotic programming languages which allow the specification of positions and actions, sequence loops and conditional actions. The great difficulty with such languages is that they tend to be produced for particular robots or types of robot and cannot cope with the wide variety of types in use. Modern developments promise languages which are more independent of the hardware, but this means finding ways of expressing actions, movements, spatial locations, and so on, that can be translated into the particular abilities of different robots.

Different forms

Arms are not the only kind of robot though. The other major group is the mobile robot. The commercial mobile robot is often a simple, motorised platform which can follow lines on factory floors through optical sensors, or routes marked by buried cables whose electromagnetic fields can be sensed. Such platforms are used to move materials, such as car bodies or machine parts, from one place on the factory floor to another, usually for the benefit of different groups of stationary arm robots. However, one European city is already experimenting with a robot bus which follows cables buried in the roads.

Mobile robots are, of course, the most common type of 'personal' robot, of which the 'turtle' is the most well-known. Turtles and buggies are tiny mobiles, usually about the size and shape of an upturned fruit bowl. They are controlled by home micros, signals from the computer being sent through an interface and along a cable, known as an umbilical, to the robot. Turtles often come

The Commodore 128

...so powerful, it's 3 computers in 1

It's a productivity computer!

The Commodore 128 will amaze you with its new generation of powerful yet easy to use productivity software. Like 'Jane', which allows you to follow simple symbols instead of typing complicated commands. And because it's so easy to learn, you'll have the 128 working hard in minutes! You get 128K of RAM both 40 and 80 column displays, and 16 colours for graphics.

It's a family and education computer!

Switch to Commodore 64 mode and you can use more than 3,000 software packages proven on the Commodore 64, The World's No. 1 selling computer. That's power – power for studying, word processing, education, home accounts, programming, fun and games and much, much more.

It's an advanced business computer!

The Commodore 128 lets you use software packages like 'Wordstar, dBase II and Supercalc', all in 80 columns. The Commodore 128 gives you all the computing power most businesses will ever need now or in the future.

Power without the price. $699.

...with new power plus peripherals

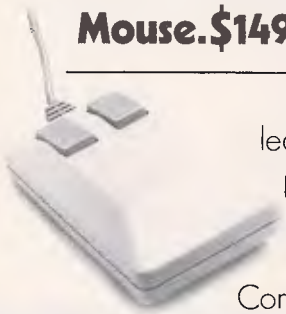
New! 1571 Single Disk Drive. $599 r.r.p.

A sleek, high performance disk drive, offering an incredible 340K storage capacity. Will read many common CP/M disk formats – ideal for productivity applications.

New! 1901 Colour Monitor. $599 r.r.p.

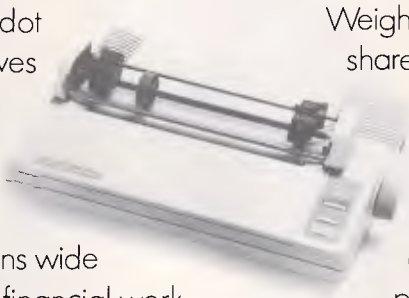
High resolution 34cm (14") screen compliments the advanced video capabilities of your Commodore 128 computer. Comes complete with selectable 80 column (RGBI) and 40 column (composite video) inputs and built in sound capability – offering you excellence and quality.

New! The Commodore Mouse. $149 r.r.p.



Ideal for learners and professionals alike! With the Commodore Mouse you don't even have to use the keyboard to get your Commodore 128 working. The Mouse serves as a pointer and input device in conjunction with programs like Jane, to let you move words, draw pictures and issue commands.

New! MPS 1000 Dot Matrix Printer.



High speed dot matrix printer gives you 100 cps to draft reports, 40 caps in near letter quality mode. 80 columns wide for financial work. Bi-directional, high resolution graphics. Great printer power at a low, low Commodore price!

New 256K/512K Expansion Cartridge.

Simply plug into your Commodore 128 and it becomes ever more powerful.

256/512K Expansion Cartridge gives you power to spare to run the big software packages or write your own programs.

New! The Commodore 128D. 'Takeaway Power' $1099 r.r.p.

Simply snap the keyboard onto this great new computer and take the carry handle – the 128D transportable goes anywhere your work or play takes you.

Weighs around 8kg, and shares all the 128's features, including 512K expandability.

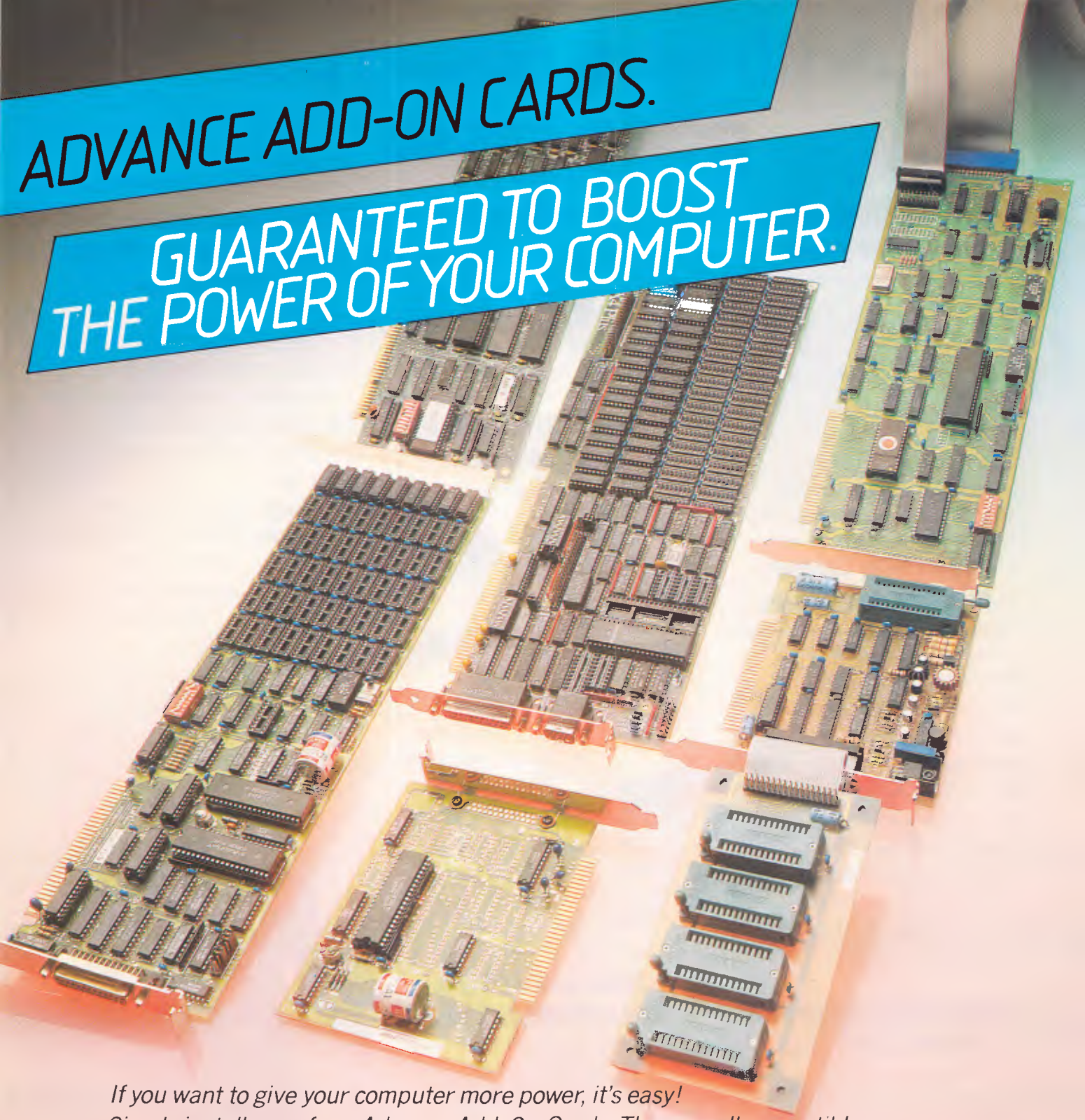
Gives you real 'takeaway' home or office computing power!

The 128D transportable – power to go!

C= commodore gives you the power!

ADVANCE ADD-ON CARDS.

GUARANTEED TO BOOST THE POWER OF YOUR COMPUTER.



If you want to give your computer more power, it's easy!

Simply install one of our Advance Add-On Cards. They are all compatible with the IBM PC/XT/AT and other IBM compatible machines; Portables too.

All cards are 100% quality controlled and designed to give powerful, long-lasting operation. Advance Add-On Cards come with a full service back-up and 12 month warranty, plus an explicit easy-to-follow step by step installation manual.

Ask your local dealer about Advance or write direct to us for more information.

ADVANCE PERIPHERALS PTY LTD.

SYDNEY: 21/84 Reserve Road, Artarmon 2064. P.O. Box 215, Gordon 2072.
Phone: (02) 439 5900. Telex: AA71517 (ADRIB)

MELBOURNE: 87-101 Roden St, West Melbourne 3003.
Phone: (03) 329 2384. Telex: AA30834 (DISPLA)

ADVANCE AP Peripherals

EXPANDING COMPUTER POWER

equipped with pens which can be lowered to trace their route on the ground, with bump sensors which indicate when they have run into something and optical sensors for following lines on the ground.

Programming a personal mobile to make simple movements is normally done in a high-level language such as Logo. This has commands which move the turtle forward and left or right. Arguments to the commands give the number of units of distance to move or degrees to turn. The following Logo commands:

FORWARD 20
RIGHT 90

instruct the turtle to move forward 20 units and then turn right 90 degrees. Logo is a complete and powerful programming language in its own right — its robotic applications being merely a development from its 'turtle graphics' commands. Its facilities for defining procedures, its recursion and list-processing make it a promising language for more advanced robotic applications involving sensing and intelligence — even though the language was originally developed as an aid for teaching mathematical concepts.

Control and operation

Controlling a robot is, in principle, much like controlling a printer. Data and control signals — the exact mix determined by the innate *intelligence* of the robot — must be sent on the output channel, while the input channel is scanned for data sent back from the robot — as a printer might send back 'fault' or 'busy' signals.

To illustrate the point, I have written a program to control the movements of the print head and carriage of an Epson printer. Think of the print head as a turtle and the paper as the ground. Using the commands RT, LT and FD the print head can be 'turned' right and left and moved forward. For simplicity, turns can only be made in 45° units, so RT 3 means 'turn three units to the right' which is equivalent to a right turn of 135°. The PEN command raises or lowers an imaginary pen to trace the 'robot's' movements. In fact it simply changes the character that is printed as the trail (space for PEN UP and '*' for PEN DOWN).

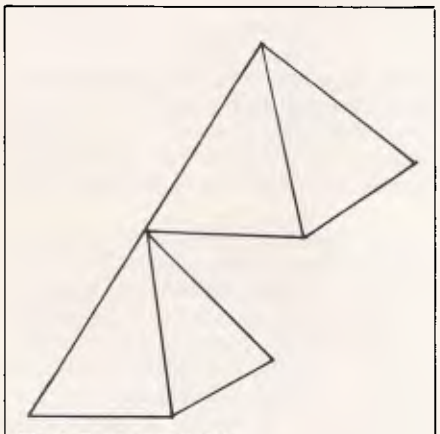
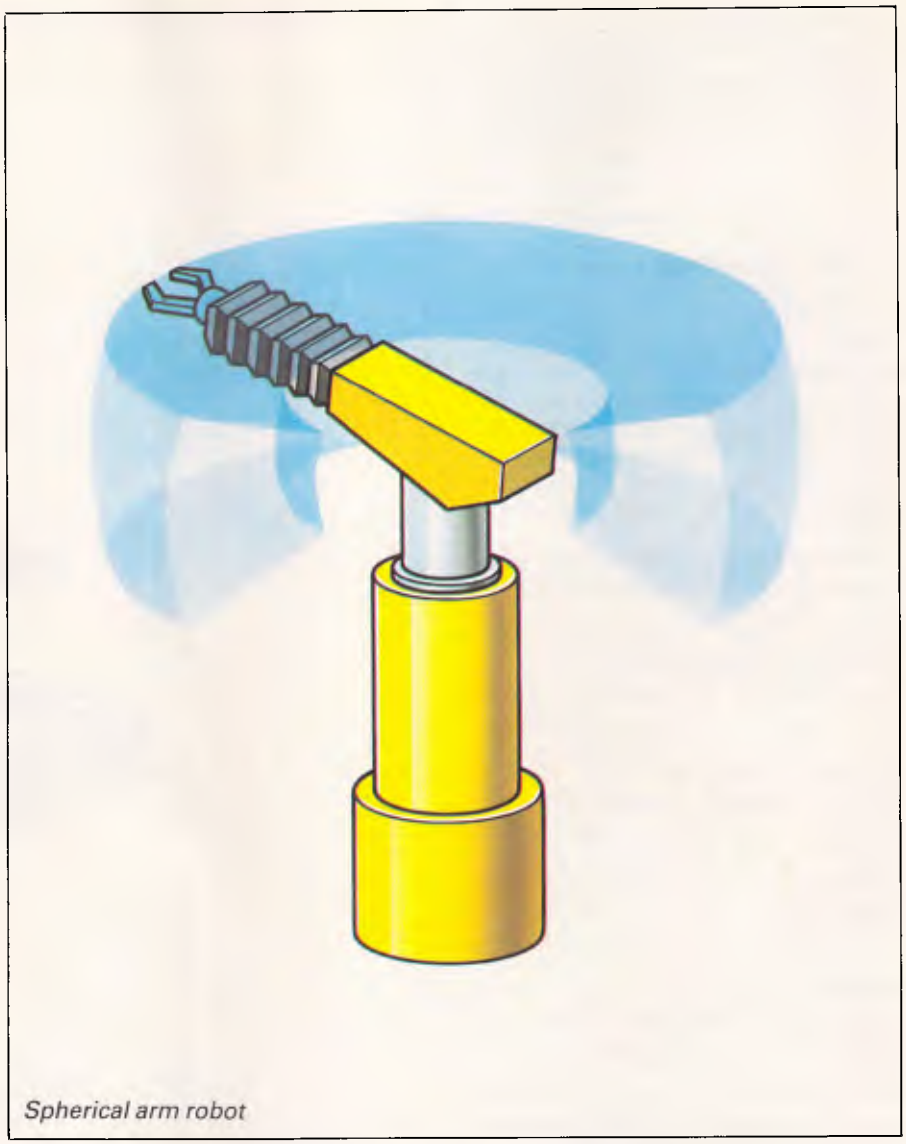


Fig 1 Two pyramids



Spherical arm robot

The 'language' for controlling the printer's movements is given effect through the four procedures between lines 1000 and 4200. Of these PROCFD is the most interesting. Taking the direction calculated by PROCRT or PROCLT it applies a set of rules between lines 4030 and 4100 to decide whether the platten should move up or down (the robot's y axis) and whether the head should move left or right (the x axis). It then applies the rules between lines 4120 and 4190 to make the necessary motions the required number of times. Instructions to the printer are sent as control codes using the sequence VDU1 (send next character to the printer) :VDUn(where n is the control code to be sent). The printer then interprets these codes as movements of its motors.

Our robot printer is, like most of today's robots, totally without senses. Yet, in the world of robotics, things are changing fast.

Perception

The first sense to be widely used was a crude sense of touch to detect contacts between the robot and other surfaces, examples of which are bump detectors. These could be implemented as microswitches attached to a bumper for instance, with their signals generating interrupts or being trapped in other ways by the software to set in motion routines which will prevent the vehicle from completing its task.

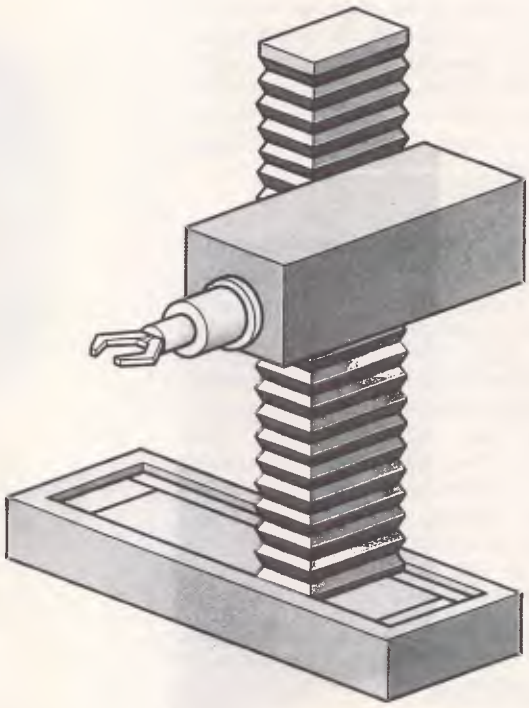
A more sophisticated sense of touch is provided by strain gauges. These can be built into the grippers of an arm robot, so that the strength of its grip on an object can be regulated. You may have seen publicity photos of a huge arm robot holding an egg without breaking it — a feat that is almost impossible without a sense of touch.

A very common task for arm robots is to assemble machines by inserting pieces into others. Strain gauges in a robot's wrist or built into the work surface can tell the controlling software how well it is doing at positioning a tool or an object with respect to the rest of the work. Excessive stresses could signal a failure to insert a piece properly and trigger routines to 'wiggle' the wrist to help find a better fit.

Moving further up the scale of sophistication, some robots are fitted with proximity sensors which can tell the controlling software when the end effector is close to an object. These are usually laser, infra-red or ultrasonic devices which transmit a beam of radiation and then measure any reflected energy. Chemical sensors are now available which, for example, indicate the concentrations of particular compounds in liquids or gasses, providing the potential for robots with a sense of taste and smell. Together with geiger counters and pressure gauges these sensors are being built into robots designed for particular industrial processes, such as nuclear materials handling and underwater maintenance work. However, the most useful sense of them all — vision — is still only available in very crude forms.

Vision processing in robotic systems is largely a matter of locating edges in an image and then constructing outlines of possible objects from them. The image itself is coded as a stream of digitised video output which must be stored by the computer prior to any computation. Analysis of this image usually starts with a search for 'contours' — the edges and boundaries signifying the outline of an object. In life, real objects do not have neat and clear outlines. In a monochrome video image, matters are many times worse — only changes in brightness mark the transition from object to background and, for curved objects, the transition can be very gradual.

In this phase of the analysis, the need is for very fast algorithms that can find and enhance the edges in the image. A little knowledge is helpful to the software, even at this low level, as it can help to fill in missing portions of a line or curve or direct the search to the most probable areas of the image in which to find particular features. The result is rather like a line drawing of the original image and is known for this reason as a 2-D sketch. Some systems also extract information about the shading of the objects in the image and add this to the analysis to produce a two-and-a-half D sketch: that is, a sketch that has some information about the three-dimensionality of the object but not a true 3-D representation because the 'back' of the sketch is still unknown.



XYZ arm robot

For most industrial applications, such as identifying parts on a conveyor belt, and judging their orientation, this level of analysis is quite adequate. The objects being searched for each have their outlines represented in memory and a pattern-matching algorithm is used to fit the 2 or 2.5-D sketch to the stored representation, doing two or perhaps three-dimensional rotations of the representation as necessary. To help extract the contours, special lighting systems have been used which throw the outlines of the objects into clear relief. Patterned lighting — say, light and dark stripes, or a grid pattern — has been especially useful for this and some systems employ 'active lighting' where the computer can control the positions of the light sources to make its view clearer. Stereo or binocular vision systems also exist, the slight disparity between two images of the same scene from different cameras providing clues as to the depth of the scene and the shapes and positions of the objects in it.

Even these kinds of simple visual processing call for massive amounts of computation and will not really be feasible until parallel processing is more widely available. Such systems cannot cope with very complex images, or moving objects, or poorly lit objects. They can neither learn nor handle objects which they have not previously encountered and they are completely useless outside

KAITEC
180 C.P.S. PRINTER
$449
SAVE $75!

XIDEX DISK SPECIALS
5¼" S/S $29.95
5¼" D/S $34.95

IBM* CLONES from only $899*

RS232 DATA SWITCH WITH TESTER
- 25 pin RS232 "D" connectors 2 in, 1 out or 1 in, 2 out.
- Ideal for 2 computers to one peripheral or 1 computer to 2 peripherals.
- No power required.
- Six dual coloured LED indicators showing certain flow status:
  T.D. Transmit Data
  R.D. Recieve Data
  R.T.S. Request To Send
  C.T.S. Clear To Send
  D.S.R. Data Set Ready
  D.T.R. Data Terminal Ready
- Housed in heavy duty metal cabinet.
- Size: 200(W)x68(H)x150(D)mm

Cat. X19110 **$149**

CENTRONICS DATA SWITCH WITH TESTER
- 36 pin gold plated female Centronics connectors.
- All other specs as for RS232 Data Switch with Tester.

Cat. X19115 **$169**

COMPUTER PAPER
Quality paper at a low price! 2,500 sheets of 11 x 9½", 60 gsm bond paper.

Cat. C21001 **Normally $44.95**
SPECIAL $37.95

BRAND NEW FANS
Not noisy pullouts! Stacks of uses in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air.

240V 4⅝" Cat. T12461 **$12.95**
115V 4⅝" Cat. T12463 **$12.95**
240V 3½" Cat. T12465 **$12.95**
115V 3½" Cat. T12467 **$12.95**
10 Fans (mixed) less 10%

APPLE JOYSTICKS
Ideal for games or word processing. Fits most 6502 "compatible" computers.

Cat. C14200 **$34.95**

JOYSTICK FOR IBM
Features Selectable "Spring centering" or "free floating". Electrical trim adjustments on both axis. 360 degree cursor control

Cat. C14205 **$39.95**

NEW TTL MONITORS
Fantastic resolution! Enjoy a crisp, sharp image with these new Ritron TTL monitors! IBM* compatible, green display, swivel and tilt base.

Cat. X14510 **$265**

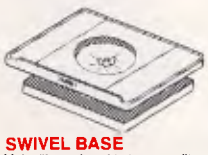
PHOENIX 5
Suits Apple, IBM, Commodore, even your VCR!
- Pal and R.G.B.
- Normal Resolution
- 13" CRT Dot Pitch 0.65mm
- Horiz. Resol. 320 TV lines
- Vert. Resol. 560 TV lines
- Display Characters 1,000 Ch.(40x25)
- 16 Colours (Pal)
- Green text display

Cat. X14522 $399

RITRON 1
Our most popular model in a steel cabinet to minimise R.F.I.

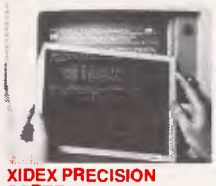
Green Cat.X14500 **Save $30 $169**
Amber Cat.X14502 **Save $30 $179**

COMPUTER CHESS! by SciSys.
SciSys computer chess games are endorsed by Garry Kasparov, world's highest rated chess player, and are available from Rod Irving Electronics!



SWIVEL BASE
Make life easier with these quality, swivel and tilt bases, complete with rubber fittings!

Cat. D11100 **$29.50**



XIDEX PRECISION SCREEN
Headaches, fatigue and tired eyes are a common complaint from users of CRT's. But studies have raported that the use of the Xidax Precision Screen, actually increases effeciency 20% while relieving eye strain, headaches and general fatigue.
Available in two sizes:

7⅞"x10½" Cat.X99997 **$49.95**
8½"x11" Cat.X99999 **$49.95**

INLINE SWITCHING BOX
- 25 pin "D" plug to 25 pin "D" socket (RS232)
- DIP switches allow easy switching of internal wiring.

Cat. P00000 **$32.95**

COMPUTER LEAD
- 25 pin "D" plug to 25 pin "D" plug (RS232) DIP switches in each plug allow many combinations of internal wiring, making this a truly universal lead.
- Mylar shielding against RF interference.
- Length 2 metres.

Cat. P19031 **$59.95**

COMPUTER LEADS
We have a wide range of computer leads available, all at low prices!

APPLE:
- Apple II, IIe, II+, with parallel interface card
- Dual 10 pin (20 contacts) connector to Centronics 36 pin plug
- Length 2.4 metres

Cat. P19025 **$29.95**

IBM
- IBM PC, XT, and look alikes with 25 pin "D" plug on computer end to Centronics 36 pin plug on printer end.
- Length 2.1 metres

Cat. P19029 **$44.95**

TANDY
- For models II/12/16/16B/2000, with dual 17 pin female on computer end to Centronics 36 pin plug on printer end. (Equivalent to 26-1323)
- Length 2.4 metres

Cat. P19027 **$34.95**

- For models I/III/4/4P, with 34 pin edge connector on computer end to Centronics 36 pin plug on the printer end. (Equivalent to 26-1401)
- Length 2.4 metres

Cat. P19028 **$34.95**

TELEPHONE CURL CORD
- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres
- Colours: cream, dark brown.

Cat. Y16022 **$7.95**

TELEPHONE EXTENSION CABLE UNIT
Allows 15 metres of telephone extension cable to be neatly wound into a protable storage container. The reel sits on a squared off base and tha reel has a handle to wind cable back on to it after use. No tangles - no mess! Ideal for the workshop, around the house, office, pool etc

Cat. Y16013 **$24.95**

IBM COMPATIBLE CARDS
NEW MOTHER BOARDS!
XT compatible mother boards, 8 slots, room for 256K RAM

Cat. X18020 **$295**

GAMES ADAPTOR CARD
Features 2 joystick ports.

Cat. X18019 **$49**

MULTIFUNCTION CARD
(384K RAM) Parallel, serial and game port. Plus battery backup clock.

Cat. X18013 **$329**

DISK CONTROLLER CARD
Controls 2 slimline drives

Cat. X18005 **$89**

HIGH RESOLUTION MONOCHROME GRAPHICS CARD
Give your IBM real graphics capability.

Cat. X18007 **$249**

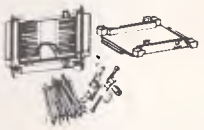
512K RAM CARD
Including RAM Cat. X18015 ~~$299~~ **$129**
Excluding RAM Cat. X18016 ~~$129~~

RS232 GENDER CHANGERS
Saves modifying or replacing non-mating RS232 cables by changing from male to female to male. All 25 pins wired straight through

Male to male Cat.X15650 **$19.95**
Female to female Cat.X15652 **$19.95**

RS232C NULL MODEM ADAPTOR
- Male to female connections
- Pins 2 and 3 reversed
- All 25 pins connected

Cat. X15658 **$22.95**



RS232 MINI PATCH BOX
- Interface RS232 devices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat. X15654 **$25.95**

RS232 SURGE PROTECTOR
- Avoids costly damage from large voltage peaks caused by lightning or other power problems
- Uses metal oxide varistors (M.O.V.) to suppress any voltage above 26V on pins 2,3 and 7.
- Will handle up to 1 Joule and 250A peak current.

Cat. X15660 **$34.95**

WE HAVE A WIDE RANGE OF CABLE AND CONNECTORS!!

RAINBOW CABLE
Suitable for IDC connectors.

Cat.No.	Description	$/metre
W12714	28AWG 14W	$1.80
W12716	28AWG 16W	$1.80
W12720	28AWG 20W	$2.20
W12726	28AWG 26W	$2.90
W12734	28AWG 34W	$3.60
W12740	28AWG 40W	$4.40

5¼" FLOPPY DISK SPECIALS!

XIDEX	1-9	10+
S/S D/D Cat C12401	$29.95	N.A.
D/S D/D Cat C12410	$34.95	N.A.
High Density Cat C12520	$125	

VERBATIM DATALIFE

S/S D/D Cat. C12501	$27.95	$26.95
D/S D/D Cat. C12504	$39.95	$37.95

VERBATIM VALULIFE

S/S D/D Cat. C12421	$24.95	$22.95
D/S D/D Cat. C12425	$31.95	$29.95

3½" DISK SPECIALS
Verbatim S/S Cat.C12372 $75
Xidex S/S Cat.C12600 $65
Xidex D/S Cat.C12602 $89

DELUXE 5¼" DISK STORAGE UNIT
Features...
- Clear smoked plastic lid
- Diskette fan display system elevates the disks for easy identification and access.
- Lockable lid (2 keys suppliad)
- High impact plastic base
- 45 diskette capacity

Cat. C16050 **Normally $49.50**
NOW $39.50

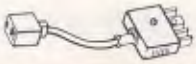
COMPUTER CASSETTES
Quality 20 minute tapes.

Cat. D11141

1-9	10+	100+
$1.00	**$0.90**	**$0.80**

RITRON (ZETA) DATASETTE
For data loading and saving, the Ritron Datasette suits most home computers and featuras tape counter, monitor function for audio verification and slide control for output level.

Cat. C14900 **$24.95**



TELEPHONE ADAPTOR
- Australian plug to U.S. socket
- Length 10cm
- Cream colour cable

Cat. Y16026 **$6.95**

IBM* COMPATIBLES from $899*
Incredible deals to suit everyone including special package deals!
*256K RAM, single drive, graphics, disk controller and printer cards.

RITRON MULTI PURPOSE MODEM
The RITRON Multi Purpose Modem has all the features you require...
- CCITT V21 300 Baud Full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect.

Telecom Approval No. C84/37/1134

Cat. X19103 Normally $399
SPECIAL $299

IC SPECIALS!

	1-9	10+	100+
4116	$1.80	$1.70	$1.60
4164	$2.95	$2.75	$2.50
2716	$5.90	$5.50	$5.50
2732	$6.25	$5.95	$5.50
2764	$6.25	$5.95	$5.00
27128	$7.00	$6.50	$6.25
6116	$2.95	$2.75	$2.50
41256	$7.00	$6.50	$6.00
6264	$6.50	$5.50	$5.25

WORLD MODEM CHIP
Cat. U21614 Normally $49.50
Save $20, NOW $29.50

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866

48 A'Beckett St, MELBOURNE, 3000
VICTORIA, AUSTRALIA
Ph. (03) 663 6151

Mail Order and correspondance:
P.O. Box 620, CLAYTON 3168
TELEX: AA 151938

MAIL ORDER HOTLINE (03) 543 7877 (2 lines)

POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.
Certified Post for orders over $100 included "free"!
Registered Post for orders over $200 included "free"!
All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE, 56 Renver Rd., Clayton Phone (03) 543 2166

MasterCard VISA

Errors and Omissions Excepted

IBM is a registered trademark of International Business Machines

INTRODUCING IBM Compatible Hi-Res Monitors from QUBIE

The HR 39 and HR 134 Monochrome Monitors are direct replacements for the IBM Model 5151 Monochrome Display. The HR 39 features a GREEN phosphor screen, while the HR 134 an AMBER screen. Both monitors plug into the IBM Monochrome Display and Printer Adaptor (or compatible) card.

The HR31 200 Colour Monitor is a direct replacement for the IBM Colour Display. It plugs into the IBM Colour/Graphics Adaptor (or compatible) card. The HR31 200 features **0.31mm dot pitch and a black matrix picture tube.** This special tube reduces glare and enhances RGB colour to ensure superb picture quality.

All three monitors include a tilt and swivel base. Use your Qubie' monitor as you would the IBM ; it will in no way affect the normal use or function of your Personal Computer.

Technical Data - HR31 200

CRT Size:	14" Diagonal (34cm)
Tube:	Black Matrix
Sync-H. Scan Frequency:	15.7kHz
V. Scan Frequency:	60Hz
Signal Type:	RGB I: TTL Level Positive Sync H/V: TTL Level Positive
Display Size (H x V):	245mm x 170mm
Retrace Time (H x V):	0.5Ms x 0.4msec
Resolution:	640 x 200 lines
Input Terminals:	9 pin "D" type connector
Dimensions:	11"(H) x 15"(W) x 13"(D) 266(H) x 367(W) x 318(D)mm
Shipping Weight:	15.9kg

Models HR 39 & HR 134

Technical Data - HR 39 & HR 134

CRT Size:	12" Diagonal (29cm)
Phosphor:	HR 39 (Green); HR 134 (Amber)
Sync-H. Scan Frequency:	18.432kHz
V. Scan Frequency:	50/60Hz
Signal Input:	Video - TTL Level Positive Sync. H - TTL Level Positive Sync. V - TTL Level Negative
Video Response:	20MHz
Display Size (H x V):	203mm x 135mm
Display Time (H x V):	44Ms x 18.99msec
Resolution:	Centre 1,000 lines Corner 800 lines
Display Formats:	9 x 14 matrix, 2000 characters in 80 x 25 format
Input Terminals:	9 pin "D" type connector
Dimensions:	10.5"(H) x 15"(W) x 12"(D) 257(H) x 367(W) x 294(D)mm
Shipping Weight:	11.36kg

All models: 240V AC/50Hz

DEALER ENQUIRIES: QUBIE

9/62 Blackshaw Avenue, Mortdale, 2223 - Phone: (02) 579 3322

America's leading distributor of IBM PC accessories is now supplying your IBM dealer locally. . .

Also available: IBM key boards, multifunction memory boards and modems.

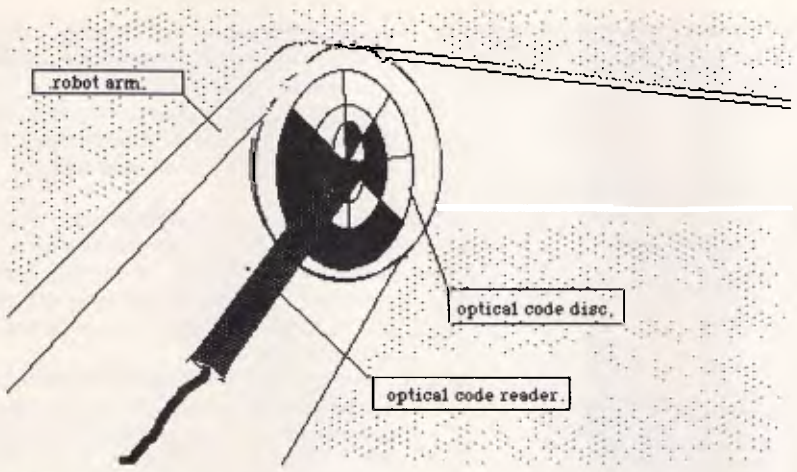


Fig 2 Optical code disk

```
10  '            ** Robot Printer **
20  '            ** By Graham Storrs for APC **
30  '
40  DEFINT A-Z
50  TRUE = 1
60  FALSE= 0
70  ESC$ = CHR$(27)
80  CLS
100 '    Initialisation and dimensioning
110 S=0 : GOSUB 1000              ' sets pen to up
120 DIR=3                         ' initial direction is 3 (90 degrees)
130 DIM WORD$(10)                 ' holds parsed command
140 DIM PENPOS$(1)
150 PENPOS$(0)="UP":PENPOS$(1)="DOWN"
160 GOSUB 7000                    ' print command summary table
500 '    main control loop
510 '
520 GOSUB 5000                    ' read and parse command line
530 IF COMM$="END" THEN END
540 GOSUB 6000                    ' execute command
550 GOTO 520
1000 '   set pen to up (s=0) or down (s=1)
1010 '
1020 PENPOS=32                    ' default for pen is 32 (ASCII space)
1030 IF S=1 THEN PENPOS=42        ' ASCII *
1040 RETURN
2000 '   calculates direction after a right turn
2010 '
2020 DIR = DIR + (UNITS - INT(UNITS/8)*8)
2030 IF DIR > 8 THEN DIR = DIR - 8
2040 RETURN
3000 '   calculates direction after a left turn
3010 '
3020 DIR = DIR - (UNITS - INT(UNITS/8)*8)
3030 IF DIR < 1 THEN DIR = DIR + 8
3040 RETURN
4000 '   moves the head forward in the chosen direction
4010 '
4020 IF DIR < 3 OR DIR > 7 THEN PLTUP = TRUE ELSE PLTUP = FALSE
4030 IF DIR > 3 AND DIR < 7 THEN PLTDN = TRUE ELSE PLTDN = FALSE
4040 IF DIR > 1 AND DIR < 5 THEN HDRT  = TRUE ELSE HDRT  = FALSE
4050 IF DIR > 5 THEN HDLT = TRUE  ELSE HDLT = FALSE
4060 '
4070 FOR J=1 TO UNITS
4080            IF PLTUP = TRUE THEN LPRINT ESC$;CHR$(106);CHR$(36);    revrse
4090            IF PLTDN = TRUE THEN LPRINT ESC$;CHR$(74);CHR$(36);     lf
4100            IF HDLT  = TRUE THEN LPRINT CHR$(8);                    bs
4110            IF HDRT  = TRUE THEN LPRINT CHR$(32);                   sp
4120            LPRINT CHR$(PENPOS);                                    plot
4130            LPRINT CHR$(8);                                         bs
4140            NEXT J
4150 RETURN
5000 '   Reads a command line and parses it
5010 '
5020 PRINT "The pen is "; PENPOS$((PENPOS-32)/10); TAB(30);
          "The current direction is "; DIR; " ("; (DIR-1)*45; " degrees)"
5030 WC = 1                                        ' word count
5035 PRINT
5036 PRINT
5040 PRINT "enter your command: ";
5050 BUFF$= ""
5060 INPUT L$
5070 L = LEN(L$)
5080 FOR J = 1 TO L
5090     C$= MID$(L$,J,1)
5095     IF C$>= "a" AND C$ <= "z" THEN C$= CHR$(ASC(C$)-32)
```

the highly artificial and stereotyped conditions for which they are programmed.

To give a vision system more flexibility and power, it needs to be given more intelligence. Fig 1 shows two pyramids. To properly interpret the picture as one pyramid standing behind the other rather than as one somehow attached to the top

'... some robots are fitted with proximity sensors which can tell the controlling software when the end effector is close to an object.'

of the other, a vision system would need to know something about the properties of physical objects. A human being possesses a certain primitive understanding about balance, stresses, the strengths of materials, and so on, which enables him to reject the unlikely interpretation that the pyramids are attached. In fact, there is a great wealth of knowledge about what is *possible* and what is *probable* in the world that we use for interpreting what we see. Finding a way of representing this knowledge in a computer program, so that it can be used effectively and efficiently, is a major focus of research in artificial intelligence today. The task is made even more difficult by the fact that we don't always know just what 'knowledge' we do use to interpret the visual world!

Understanding

The basic difficulty with robot senses — and nowhere more so than in vision — is not in providing the sensor itself, but in interpreting the output the sensor generates. An optical encoder, for

'Chemical sensors are now available which, for example, indicate the concentrations of particular compounds in liquids or gases.'

instance, will generate streams of bit patterns (Fig 2) but the computer must be able to interpret these as rotations of wheels or movements of joints. Furthermore, the outputs from several optical encoders, strain gauges and potentiometers must all be integrated if they are to provide a robot with a sense of the positions and movements of its own body parts (a kinaesthetic sense —

```
5100      IF ASC(C$)<>32 THEN BUFF$=BUFF$ + C$
                         ELSE WORD$(WC%)=BUFF$: WC=WC+1: BUFF$=""
5110      NEXT J
5120 WORD$(WC) = BUFF$
5125 CLS
5130 IF WC>2 THEN PRINT "** command too long **" :
                  PRINT '** only first two words have been read **" :
                  WC = 2
5140 IF WC<2 AND WORD$(1)<>"END" THEN PRINT "** command too short **" :
                  PRINT '** two words are necessary **" :
                  GOTO 5020
5150 COMM$=WORD$(1): ARG$= WORD$(2)
5160 RETURN
6000   executes the command
6010
6020 IF COMM$="PEN" AND ARG$="UP" THEN S=0 : GOSUB 1000 : GOTO 6090
6030 IF COMM$="PEN" AND ARG$="DN" THEN S=1 : GOSUB 1000 : GOTO 6090
6040 IF COMM$="FD" THEN UNITS=VAL(ARG$) : GOSUB 4000 : GOTO 6090
6050 IF COMM$="RT" THEN UNITS=VAL(ARG$) : GOSUB 2000 : GOTO 6090
6060 IF COMM$="LT" THEN UNITS=VAL(ARG$) : GOSUB 3000 : GOTO 6090
6070 PRINT
6080 PRINT COMM$; " is not a legal command "
6090 RETURN
7000   print command summary table
7010
7020 PRINT
7030 PRINT TAB(10); 'COMMAND   ARGUMENT      PURPOSE"
7040 PRINT TAB(10); ~~~~~~~   ~~~~~~~~      ~~~~~~~"
7050 PRINT TAB(10); " PEN        UP          raises pen so no trail is made"
7060 PRINT TAB(10); " PEN        DN          lowers pen to leave trail"
7070 PRINT TAB(10); " FD         n           move forward n units"
7080 PRINT TAB(10); " LT         n           turn left by n units"
7090 PRINT TAB(10); " RT         n           turn right by n units"
7100 PRINT TAB(10); " END        -           quit the program"
7110 PRINT
7120 RETURN
```

Robot printer program

essential for robots which must balance themselves). It is this need for interpretation that is holding up the development of robot sensory systems. Quite simply, we do not yet know how to make programs that are clever enough for the task.

In fact there is a widespread need for intelligent software in robotics for such tasks as perception, planning, understanding, learning, cooperating and communicating (with other robots as well as with people).

We are fast reaching the stage where progress in robotics is having to wait for progress in AI — a situation known as the 'artificial intelligence bottleneck'. Whether or not we manage to remove this bottleneck is still anybody's guess. On the strength of the enormous benefits to industry and to society as a whole that widely available, inteligent robots would certainly bring, a massive research effort is underway.

END

Samsung the world's most amazing monitor at amazingly low prices.

Korea's largest computer manufacturer, Samsung, is available in Australia through Amust.

Samsung have been working together with NEC since 1977 and now manufacture Hewlett Packard, Apple, Lisa and MacIntosh monitors for the U.S. market.

With the strictest Japanese quality control and engineering, Samsung are very rapidly becoming the first choice in this very competitive world of computers.

Now Amust offer you the amazing Samsung monitor in a choice of flat anti-glare screen with tilt and swivel base or standard screen and base at a price that's up to 20% below their nearest competitors!

GR1S	Composite green 22 MHz
GR1F	Composite green 25 MHz Tilt/Swivel base

There are a number of models to choose from:

GR2S	TTL (IBM) 9 pin 20 MHz
GR2F	TTL (IBM) 9 pin Tilt/Swivel base, flat screen
GR1/2S	TTL/Composite switchable green 20/25 MHz

All above models except GR1/2S available in amber.

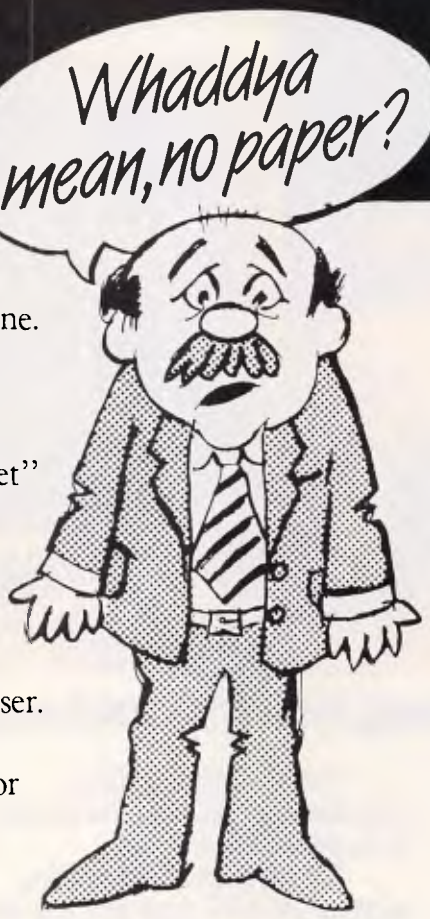
Keep abreast of the latest computer developments by choosing the amazing Samsung.

Amust

For the name of the nearest Amust dealer in your State. Telephone (03) 555 3644.

350 South Road, Moorabbin.

Chances are when you get your new computer, there'll be something missing.



It can take over six weeks for custom produced stationery to arrive.

So you won't be able to compute on day one.

Rediform instant computer stationery complements all of the popular business accounting packages for micro's, covering everything you're likely to need from "pre-set" invoices, remittance advices and statements to plain print out paper.

Rediform "pre-sets" have space for your company name, address, phone number and other necessary identification so they're particularly suitable for the small computer user. In the interim or long term.

Clip the coupon for further information or your nearest supplier. And remember, don't leave the computer store without Rediform.

Then you can start on day one.

REDIFORM

Instant Computer Stationery.

☐ Please send me more information on Rediform. ☐ Please let me know where my nearest dealer is.

To: Sales Promotion Manager
Rediform
P.O. Box 180
RICHMOND VIC 3121

NAME _____

COMPANY _____

ADDRESS _____

POST CODE _____ PHONE _____

ANG/RA/841

Microexpert

For the average user expert systems seem to require an expert to understand them, but not so Microexpert. As an entry level introduction to the world of knowledge bases, it's excellent, says Noel Williams.

McGraw Hill's Microexpert is something of a pleasant surprise. It does not claim to be a sophisticated state-of-the-art, ultra-subtle system. Instead it is presented in the simplest possible form containing enough friendliness and clarity to be used by a novice, yet it is at the same time cheap, practical and useful. The system is really an 'entry level' expert system for those who are not really sure what such a system is, how it works or what can be done with it. Beverly and William Thompson have created a useful system which can be readily understood by both users and programmers with no AI experience, a package which can be easily adapted, expanded and modified.

Aiming for the widest possible market at this level, Microexpert is currently available for the IBM PC with 128k and DOS 2.0 or higher, the Macintosh and Apple II. All versions require dual disk drive systems and each sells for the same price, $74.95, for which you get a single disk and a 72-page manual in an attractive plastic folder.

Design

Unusually, Microexpert is written in Pascal. Also, source code is given and several chapters in the manual are dedicated to implementation details and possible improvements. This is praiseworthy. It shows the designers have thought primarily about the needs of the novice user who wants to learn about the nature and structure of expert systems, of the programmer who may not be trained in the AI languages of Lisp and Prolog, and of the user who finds he might even get confused interrogating a simple relational database. The source code (about 96k altogether) is heavily commented, well structured and easily altered, providing you either have Turbo Pascal or are willing to convert to your own Pascal. Users are positively encouraged to adapt the program to their own ends, which is perhaps just as well as one of the inevitable features of an introductory system is its inadequacy for certain kinds of tasks.

Essentially the rules in the knowledge base enable the construction of a binary tree consisting entirely of AND clauses. Knowledge bases can be created with any standard text editor, such as WordStar, and take the form of IF clause (AND clause ... AND clause) THEN conclusion. A sample rule in one of the four small knowledge bases supplied with the system is:

3
If class is gymnosperm
and leafshape is scalelike
then family is cypress.

This consists of the rule number, 3, a conditional portion made up of two clauses joined by AND and a conclusion. Only one relation (or predicate) is allowed in the basic clause structure, namely 'is'. All rules can be expressed in language as natural as this, though it must be said that this can lead to some slightly tortuous rule structures and the English of the output is sometimes perplexing, especially if you have not read the manual from cover to cover.

OR conditions are not built into the system, though they could be added. Uncertainty has no place in the decision process — each decision is binary, with the inference engine (the algorithm which interprets the rules in the knowledge base) employing only a simple three value logic — TRUE, FALSE and UNKNOWN.

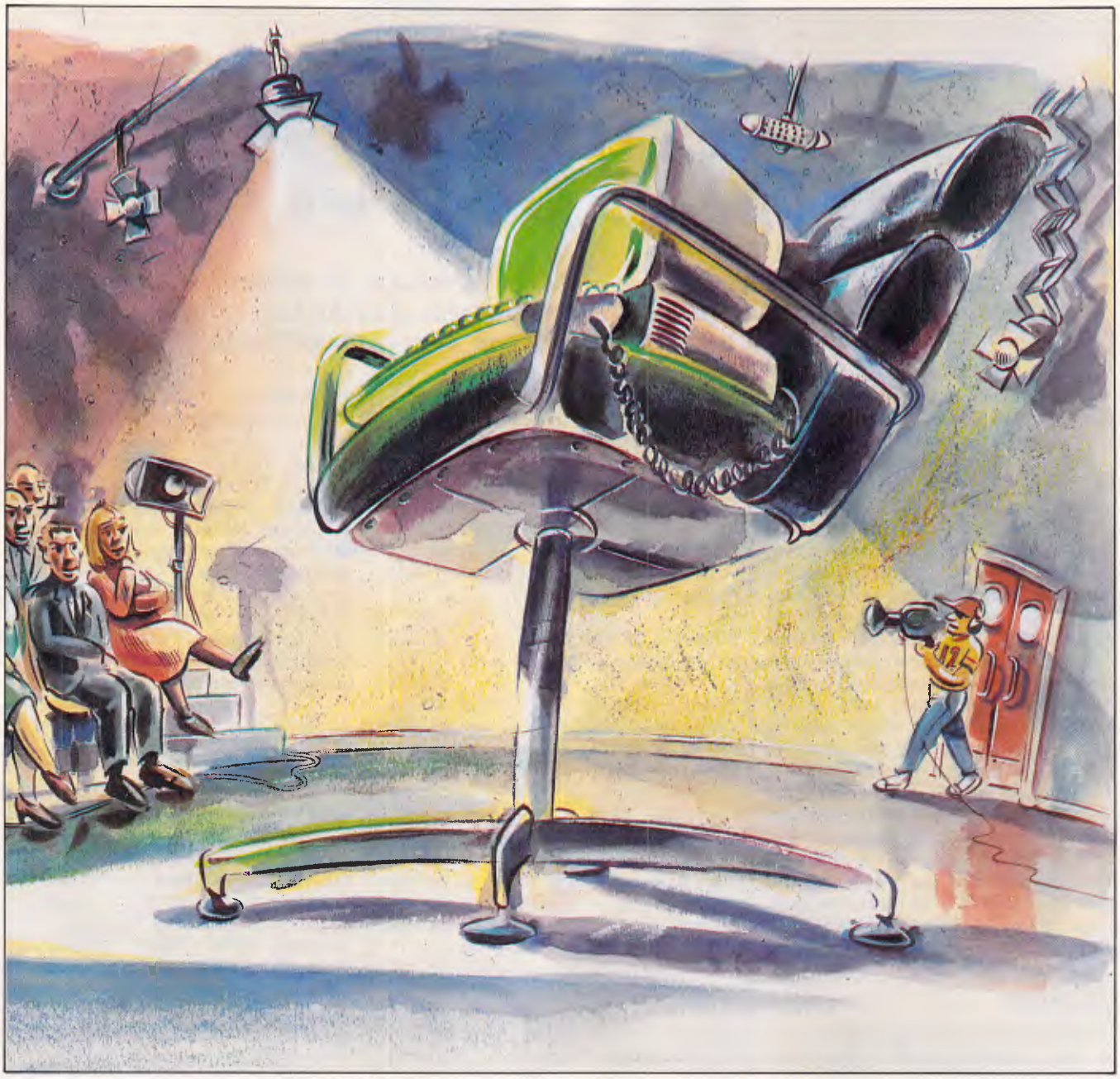
The inference engine is a backward-chaining production system: it works by attempting to establish a goal by discovering the truth or falsity of the conditions which would satisfy that goal. So, given the THEN part of a rule, it attempts to establish it by establishing the truth of the clauses in the IF part.

The task of establishing the truth of a particular clause is thus a subgoal of establishing the truth of the main goal, so the system works backwards from the desired conclusion through all its implicit subgoals until sufficient have been established to satisfy the main goal. The truth or falsity of a given condition is determined either by establishing the truth of another condition using a rule in the system or by asking the user for information using a prompt. Prompts are held in the knowledge base in association with the attributes of conditions they apply to. For example, a prompt associated with the above rule is: 'Is the leaf shape needlelike or scalelike?' This is used where the system needs to establish the leaf shape of a plant and no rule can be found which establishes that shape. In addition the knowledge base can incorporate translation phrases which can be used to rephrase a terse rule more expansively.

Features

One feature of the system which approaches the advanced or sophisticated category is the explanatory ability of the system. This is essential to any expert system if there is a risk that the user will not understand how a particular chain of reasoning operates. The requests WHY, HOW, WHAT and WHATIF allow a user to explore the reason that the system is asking for a piece of information, the chain of reasoning which can establish a given fact and the conclusions which are possible from the current state of the evidence. These features not only aid understanding of the program but also provide debugging tools for exploring the reasoning chains implicit in a given knowledge base. Debugging is further aided by the provision of the CROSS-REF utility which allows a user to view the interrelations between rules in a knowledge base.

A second versatility is the ability to incorporate user-defined procedures and functions into the rules. In principle this means that complex conditional tests and programs can be incorporated within a knowledge base, though any but the built-in procedure 'math' and function 'compare' will have to be added to the system by the user. Math enables integer arithmetic to be performed (so that, for example, the sum of the values of two attributes can be tested), while compare allows a rule to make a com-



parison between two attribute values. At its simplest this allows rules to include more complex conditional tests than the simple ANDing of two or more short clauses, which will enable a programmer to incorporate features such as fuzzy logic if so desired. At its most complex, complete subprogram fragments could be built into the system which could perform any action programmable in Pascal as part of the inference procedure. This makes for an infinitely variable structure but it also weakens the clearly defined and elegant inference engine as supplied.

User image

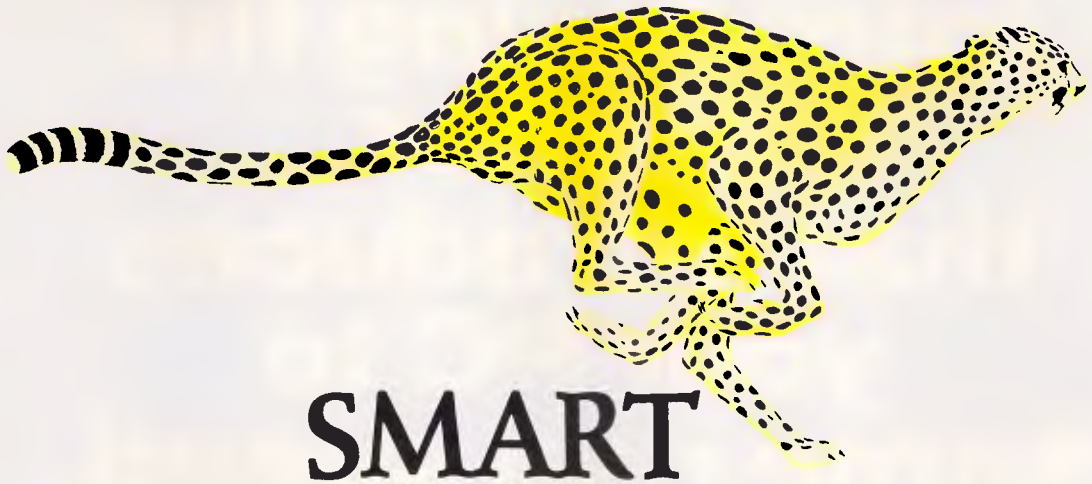
You need twenty minutes tutorial with the system to be able to interrogate it, and three or four hours to become confident in creating your own knowledge base. For most small businesses which might be attracted by such a system, this is extremely cost effective. At the price it is even worth buying simply as an educational tool for programmers to cut their AI teeth on.

Microexpert's main drawbacks are the direct result of the aim for simplicity. The lack of any built-in uncertainty in rules, the reliance on a binary tree and the omission of OR conditions means that the analyst's traditional decision trees cannot be encoded other than in exceptional cases. Only highly structured problems can thus be explored using this system which may lead users to conclude, erroneously, that less structured domains cannot provide suitable material for Intelligent Knowledge Base Systems (IKBS). Expert systems actually can prove more valuable in semi-structured domains than in completely predictable areas.

I would have liked a little more explanation of the considerations behind implementation decisions and of the theory behind expert systems. The typical buyer of a system like this will probably be using it to learn about IKBS. A book on these topics is promised soon and a short bibliography is given (though some of these items are not specifically concerned with expert systems).

Conclusion

For the business user there is virtually no mention of the possible applications for such a system. But if you want a low level introduction to expert systems you could do much worse than Microexpert. END



SMART POWERFUL FAST

Sensible Solution will slash your programming time!

This powerful data base and programming tool cuts business application programming by two-thirds. And the speed of the resulting programs is second only to Assembler programs. SENSIBLE SOLUTION programs and files are totally transportable, and limited only by the O/S of the machine it's on.

With single and Multi-user versions with complete record and file locking, Sensible Solution programs are running on most popular networks, inc. Novell, PCnet, 3Com Ethernet, CP/NET & DR/NET. Syntax errors are impossible, and the English language programs are automatically compiled as the screens are painted from the menu.

'The SENSIBLE SOLUTION'

Compare these features . . .

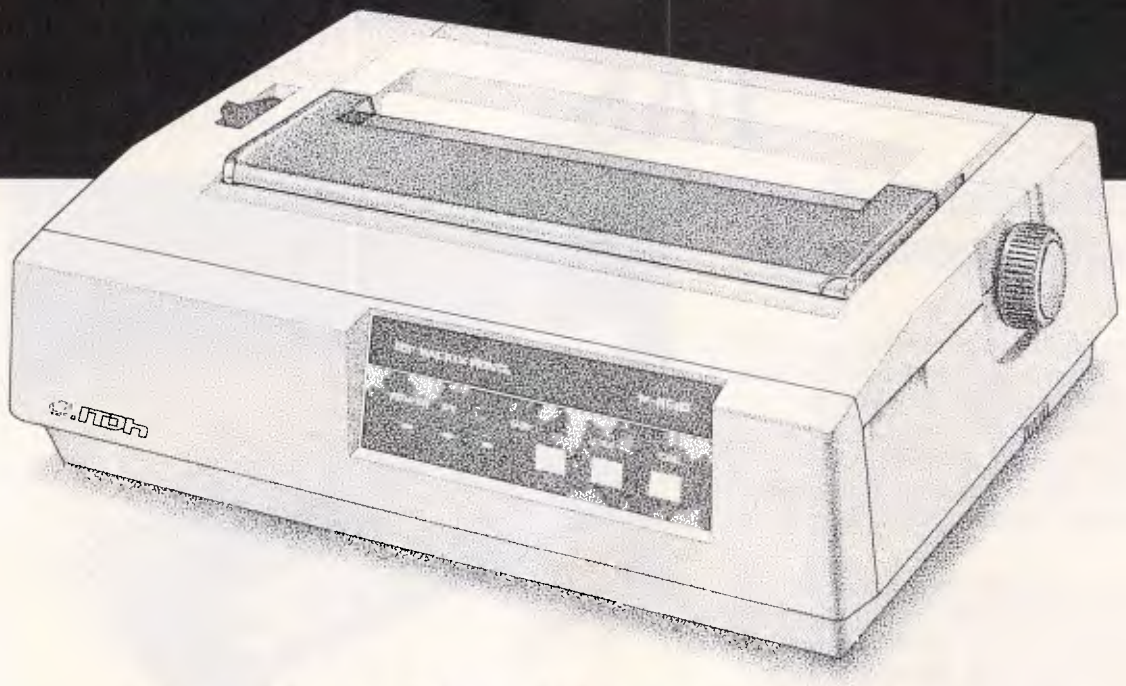
- ☐Menu driven
- ☐No Syntax errors
- ☐Automatic program generation
- ☐Compiled code
- ☐Plain English programs
- ☐File & record locking
- ☐Runs under CP/M, MS/DOS, Turbo-DOS, n/Star, McNOS, DPC/OS families
- ☐Single & multi-user
- ☐Complete DBMS
- ☐Unlimited No. of Data Files
- ☐Max. Records 16 million

MONEY BACK GUARANTEE
EXCLUSIVE OFFER

compsoft
Computers, Software, Service & Support.

COMPSOFT Australia Pty Ltd 417 Wickham Tce. Brisbane, Qld 4000 Tel: (07) 839 0066. TLX: 41181

Introducing the printer that introduces your PC to some real speed.



ProWriter™ by C.Itoh

In one minute, a C. Itoh ProWriter can print up to 100 full lines of data. In one second it can print up to 75 characters per second of correspondence. There are no other printers at ProWriter's price that are as fast.

As needle-sharp. As reliable. Or better backed. All C. Itoh Pro-Writers come with a full warranty and service nation-wide. Come be introduced to a real printer for your PC. ProWriter, by C. Itoh. Only at your Authorised C. Itoh dealer.

Distributed exclusively in Australia by:–

anitech
A DIVISION OF THE ANI CORPORATION LTD (INC IN N.S.W.)

ADELAIDE: (08) 356 7333 **BRISBANE:** (07) 275 1766 **HOBART:** (002) 34 4511
MELBOURNE: (03) 795 9011 & 795 5111 **PERTH:** (09) 277 7000 & 277 1944
SYDNEY: (02) 648 1711 & 648 4088 **AUCKLAND:** (09) 444 2645

ProWriter is a Trademark of C. Itoh Digital Products

The Final Cartridge

It's good, there's no doubt. But can it justify a $159 price tag?
Steve Withers decides . . .

The Final Cartridge for the Commodore 64 combines functions from several different types of enhancement modules into a single package. The enhancements include tape and disk accelerators, printer software, "toolkit" commands, a machine language monitor, a reset switch, and various other odds and ends. There is little about the cartridge that is new, but it provides an unusually broad set of facilities.

Basic Enhancements

This cartridge does not extend Basic in quite the same way as Simon's Basic and similar products do. Generally speaking, their emphasis is on making programming easier by providing keywords to replace PEEKs, POKEs, and the like. Very few of the functions provided by The Final Cartridge (TFC from now on) would be used in a program, instead it provides a number of tools to ease the task of entering the program into the computer and debugging it.

Automatic line numbering is a convenience, especially when typing in programs from printed listings. Typically, you'll save three keystrokes per line, and anyway, computers are supposed to relieve us of tedious, repetitive tasks. The AUTO command handles line numbering with any starting value and increment.

Program renumbering is a contentious issue. There are times when it becomes virtually essential, as it is possible to run out of numbers when adding lines to a section of a program. However, one school of thought holds that all subroutines should start on a round line number (10000, 11000, etc) for clarity. Such a scheme is wrecked by renumbering, but I find uneven line numbering more distracting. Like AUTO, RENUM allows you to specify the numbering pattern.

The FIND command locates all occurrences of a specified string, keyword, or variable. Some time ago, I used a toolkit ROM with a Commodore PET, and although the AUTO and RENUM commands were very handy, I never had much use for FIND. I suppose it could be useful while debugging a program, as you could find every place where a particular variable was assigned a new value.

HELP is much more useful. After an error occurs, this command lists the offending line. Since most of the errors that appear during the first few runs are due to finger trouble (for example, FIR I=1 TO 5), the combination of HELP and the Commodore's screen editor simplifies corrections.

I never understood why it should be necessary to destroy the program in memory in order to see a disk directory. Well, with TFC it isn't.

The two remaining commands are back in the "well, it could be useful" category. OLD simply reverses the effect of NEW. This is an idea that pops up quite regularly, so either it's easy to implement or a lot of people zap programs by mistake. I've accidentally deleted my share of disk files, but I've never lost a program that was in memory.

Deleting a block of lines from a program by typing each line number in turn is tedious, but again I ask: how often do you need to do it? The only situation I can think of that would call for the DEL command is if you wanted to extract some useful subroutines from a program for later use.

Disk and Tape Support

How many people use both disk and tape with a C64? Not many, I imagine, will therefore take advantage of all the features of TFC.

The disk turbo claims to improve the loading speed by a factor of five. This is the same sort of improvement promised by other fast loader products, and TFC's actual performance on unprotected disks matches both the claims and the opposition. One important difference is that the manual accompanying TFC warns that the effect of the disk turbo is greatly reduced by most copy-protection schemes — other software companies shy away from this problem with vague claims that their product 'will work with' protected disks, meaning the system won't crash, but might take as long as ever to load.

Several useful disk commands are provided.

DLOAD"program

(no, the closing quote isn't necessary) replaces both

LOAD"program",8

and

LOAD"program",8,1

Admittedly, that doesn't save many keystrokes, but it does mean you needn't worry about which form of the LOAD command is appropriate for a particular program.

DSAVE and DVERIFY are also included, although the latter works at the 1541's normal speed.

DAPPEND simply loads a program from disk and tacks it onto the end of the one already in memory. Line numbers are not affected, so careful planning is necessary if you intend to use the command in conjunction with a library of subroutines, as problems could result if a

DISCWARE

Super Specials for this month only

Lotus 123 rel. 2.0	$835.00	this month only	**$535.00**
Safeguard 10MB ext. tape...	$1890.00	this month only	**$1790.00**
20MB Hard Card	$2465.00	this month only	**$1495.00**
Paradox	$995.00	this month only	**$call**

IBM Software

	R.R.P.	Our Price
Attache accounting	call	**call**
Borland's Superkey	149.00	**99.00**
Cash Desk***	725.00	**555.00**
Clipper Compiler dB III	995.00	**call**
Concurrent PC DDS 4.1	555.00	**399.00**
CopyIIPC	95.00	**85.00**
Copywrite	125.00	**95.00**
CPA+***	795.00	**670.00**
Crosstalk XVI	249.00	**149.00**
dBase III ***	976.00	**685.00**
Easy!	240.00	**215.00**
Enable	1100.00	**call**
Flight Simulator ver 2.12	115.00	**89.00**
Framework ***	1095.00	**775.00**
Gateway Viatel	199.00	**170.00**
GATD, Wishbringer, King's Quest	ea 69.00	**ea 65.00**
GEM DRAW/DESK TDP	395.00	**315.00**
GEM Write/Paint	340.00	**285.00**
Graftalk ***	670.00	**570.00**
Harvard Total Project Manager ***	649.00	**490.00**
Hi-Tech C Compiler 8088/86	300.00	**280.00**
Human Edge Mind Prober	69.95	**50.00**
Information Business Manager	540.00	**440.00**
JET: fly an F.18	99.00	**80.00**
Keyworks	165.00	**129.00**
Knowledgeman 2.0 ***	945.00	**715.00**
Lattice 'C'	790.00	**690.00**
Lotus 123 rel. 2.0	835.00	**565.00**
Microsoft Multiplan	379.00	**269.00**
Microsoft Word***	599.00	**429.00**
Microsoft Word+Mouse ***	799.00	**599.00**
MultiMate 3.3	645.00	**519.00**
Newsroom	89.00	**75.00**
Norton Utilities 3.1	199.00	**129.00**
Notebook II	350.00	**295.00**
Open Access IBM/NEC/Wang ***	995.00	**725.00**
PC Alien	95.00	**80.00**
PC Tutorial	50.00	**42.00**
Perfect Filer	325.00	**245.00**
Perfect Link	189.00	**159.00**
Perfect Writer	359.00	**299.00**
Printshop	89.00	**72.00**
Printworks	149.00	**139.00**
Reflex	199.00	**169.00**
Remote	239.00	**169.00**
Samna Plus/Samna III	fr 795.00	**fr 635.00**
Side Kick ver.1.5	99.00	**72.00**
Sideways	95.00	**79.00**
SmartKey	79.95	**67.00**
Smart Software System 2.0	1045.00	**845.00**
Spellbinder	795.00	**559.00**
Supercalc 3 ver 2 w/Fast Math	675.00	**419.00**
Sybiz accounting	call	**call**
Symphony 1.1	1095.00	**705.00**
Think Tank	349.00	**270.00**
Timeline *** ver 2.0	760.00	**599.00**
Transporter	319.00	**269.00**
Turbo CAD***	1299.00	**990.00**
Turbo Gameworks	129.00	**99.00**
Turbo Graphix Toolbox	99.00	**80.00**
Turbo Lightning	190.00	**150.00**
Turbo Pascal 8087, BCD	125.00	**fr. 89.00**
TypeQuick	77.00	**72.00**
VTEX Viatel s/ware IBM/NEC/Wang	190.00	**170.00**
Word Perfect	685.00	**515.00**
Wordstar	575.00	**339.00**

IBM Software

	R.R.P	Our Price
Wordstar 2000	595.00	**455.00**
Wordstar 2000+***	795.00	**460.00**
Wordstar Professional	595.00	**455.00**
Software not listed: call for best price	call	**call**

DISKS

1.2 MB disk for AT	120.00	**75.00**
3.5 micro floppies	75.00	**55.00**
Fuji	79.95	**37.00**
Xidex DSDD	65.00	**40.00**

Modems

NetComm Smart 1234	**$ call**
DataSat Viatel modem	**$359.00**
Netcomm In/Modem	**$499.00**
Netcomm Smart 1200	**$829.00**
Netcomm Smart 123	**$ call**
Netcomm Smart 2123	**$589.00**
Netcomm Smart 2400	**$1149.00**

IBM Hardware (sales tax included)

Intel Above board	**$569.00**
64KB buffers	**$285.00**
8087	**$269.00**
AST 6Pak with Sidekick	**$569.00**
Easy LAN starter kit	**$279.00**
Hercules Graphic card	**$699.00**
Irwin 10MB tape external	**$1675.00**
Irwin 10MB tape internal	**$1290.00**
Microsoft Mouse	**$240.00**
Qubie 10MB hard disk	**$1090.00**
Qubie 20MB hard disk	**$1190.00**
Qubie 44MB hard disk	**$2700.00**
Qubie 4×4 Plus card	**$790.00**
Qubie 6Pak	**$379.00**
Qubie color monitor	**$699.00**
Sigma color 400	**$1150.00**
Sigma Maximizer AT	**$650.00**
Sigma Maximizer PC	**$449.00**
Sysgen 60MB tape	**$1990.00**
Tandon 10MB hard disk	**$1150.00**
Tandon 20MB hard disk	**$1290.00**
Tandon 42MB hard disk	**$3200.00**
Taxan Super Vision III	**$765.00**
Taxan Super Vision IV	**$1050.00**
Expansion 60X, 5 slots	**$599.00**
Tulin 32MB hard disk	**$call**

Printers (sales tax included)

Brother M1509	**$689.00**
Epson FX100+	**$899.00**
KEL 3080 (18 pins)	**$525.00**
NEC ELF Spinwriter	**$699.00**
NEC P2 Color	**$1150.00**
NEC P3 Color	**$1450.00**
NEC P3 Pinwriter	**$1199.00**
NEC P5 Pinwriter	**$1840.00**
NEC Spinwriter 2000	**$950.00**
NEC Spinwriter 3500	**$1690.00**
NEC Spinwriter 8800	**$2790.00**
Toshiba P1340	**$call**
Toshiba P1351	**$call**
Toshiba P351 Printer	**$call**

Computers

Kaypro 286i System 1 **$4950**
512KB, 1.2MB floppy, Taxan mono screen

Kaypro 286i System 2 **$5950**
512KB, 1.2MB floppy, 20MB hard disk, Taxan mono screen

Kaypro 286i System 3 **$11800**
512KB, 1.2MB floppy, 44MB hard disk, Taxan Super Vision IV, Sigma color 400, 60MB Sysgen tape

Free catalogue! Discware have just produced a complete catalogue of IBM software and peripherals. Call for your copy today.

*** *demo disks available at cost, please enquire.*

Call for specials and sales-tax exempted prices: (02) 212-6933, Viatel Order by phone, Viatel or send cheque or money order to: DISCWARE, 5th floor, 3 Smail Street, BROADWAY NSW 2007 TLX: AA23509.

For all products not listed call (02) 212-6933, or 212-6552. Viatel * 778 000#

All products carry full warranty. We support what we sell. All products are latest release versions. Delivery extra.

Software from Arcom Pacific, Imagineering, SCA, Microsoft, Digital Research, Sourceware, Software Source, Intelligence, MicroPro, Ashton-Tate, Sorcim and others.

COMPUTERS AND SOFTWARE BARGAINS

Telephone: (02) 212-6933 **Viatel ★778 000#** **TLX: AA23509**

DISCWARE, 5th Floor, 3 Smail Street, Broadway NSW 2007.

If you are impressed by our prices and our product range, you would be even more impressed if you knew who some of our clients are:

BHP, Burns Philp, Commonwealth Bank, CSIRO, CIG, TAA, Telecom...

Why do some of Australia's top companies come to Discware for their computing needs?

Is it because our prices are the lowest in the industry?

or is it because we offer fast service, professional advice and an unmatched range of equipment and software from the world's leading companies: **Olivetti, Kaypro, Toshiba, NEC, NetComm, Intel, Lotus, Microsoft, Borland, DRI, Imagineering...**

Call Discware today to find out.

Limited Availability at these prices

Now, there's an alternative: the Olivetti-AT&T computers

Olivetti M24 Twin Disk Drives **$3690**
640KB RAM, 2 x 360KB floppy disk drives, hi-res green or amber monitor, parallel and serial ports, 6 month warranty.

Olivetti M24 Hard Disk **$4790**
640KB RAM, 20MB internal hard disk, 360KB floppy disk drive, parallel and serial ports, hi-res green or amber monitor, 6 month warranty.

Olivetti M24 SP **$ call**
8086 @ 10MHz, 640KB, 20 MB, limited stock.

Kaypro 2000 **$2995**
8088 CPU, 256KB (768KB option +$50.00), 8087 option, 720KB 3.5" floppy, real-time clock, bundled software.

Toshiba T1100 **$2695**
256KB RAM, 3.5" floppy, RGB.

Kaypro 2 **$1650**
Z80 CPU, 640KB, twin 200KB disks, monitor, bundled software.

Kaypro 2X **$1700**
Z80 CPU, 64KB, twin 400KB disks, monitor, complete with bundled software.

Just released!

Free 512KB upgrade with first 5 Kaypro PC's sold this month.

Kaypro PC
the made-in-USA PC/XT compatible computer that's the price/performance trendsetter. **from $1595**

8088 CPU, 256KB RAM (768KB option), std 360KB drives, multi-video board, 9 slots, 135W power supply, hard disk option, AT-style keyboard and enclosure, serial & parallel ports, MS DOS & GW Basic.

Software included with the Kaypro PC:
Wordstar Professional, Correctstar, Star Index, Mite, Polywindows Desk

Kaypro PC Twin Disk Drives $1995

Kaypro PC Hard Disk **$call**

Peace of mind in three sizes.

Now Fuji brings you excellence in floppy disks.

There's nothing more frustrating than having a disk go down when it is filled with valuable data. That was our understanding when we first started designing our floppy disks.

We decided to do it right!

The result is a range of products that is so reliable, it carries a lifetime warranty.

The excellence that is relied upon with our photographic products is now available in our range of highest quality disks. Ask for them by name.

SELECTED SUPPLIERS

N.S.W. SYDNEY: Contact Computer Supplies 419 4908 — A B Office Electronics 9497195 — C A E Electronics 621 4242 — Calmar Distributors 698 1999 — The Computer Shop 517 2999 — Intelligence 699 3877 — Lamron 808 3666 — Logical Solutions 212 6655 — Manly Stationery Supplies 938 2522 — Mitsui Computer 451 7711 — Office World 439 8077 — Pre-Pack Electronics 569 9797 — R.I.O. Distributing 399 9900 — Thinking Systems 560 0666 — Transcript 764 2177 — The Computer Stationery Co 635 1339 — **DUBBO:** Orana Cash Registers 825 833 — **WOLLONGONG:** Altech Electronics 843 059 — Business & Leisure 299 744 — **WAGGA:** Verlynne Computer Services 21 6522 — **VIC. MELBOURNE:** Goodman Cannington 429 8011 — Output Media 544 4400 — Copy Source 429 9355 — Ray Cross Electronics 762 8566 — **BALLARAT:** Ballarat Image Supplies 35 7298 — **GEELONG:** Systems Stationery & Computing 222 844 — **HAMILTON:** Sovereign Office Machines 72 2333 — **WARRNAMBOOL:** C.J. Computer Systems 62 8178 — **QLD. BRISBANE:** The Byte Shop 371 0711 — C.W. Electronics 397 0888 — Computer Paper Supplies 369 5277 — Design Offices Co-op 831 4977 — **CAIRNS:** Cairns Stationery Supplies 51 2277 — **MT. ISA:** Barkly Computer 43 2929 — **SOUTHPORT:** Stateside Gold Coast 32 8988 — **S.A. ADELAIDE:** Boss Business Products 233 2224 — Perce Burton Business Equipment 212 2611 — **MT. GAMBIER:** Southeast Business Machines 25 8900 — **W.A. PERTH:** Jays Business Equipment 381 8700 — Regional Computers 328 9062 — **BOULDER:** Computers West 21 6961 — **KARRATHA:** Dave's Oscitronic 85 4836 — **A.C.T. BELCONNEN:** Actcom Computer 51 4307 — **TAS. HOBART:** Southern Star Industries 72 9530 — **LAUNCESTON:** Computer Craft 31 8133

Trade Enquiries **Fujimex** a Division of **HANIMEX** (02) 938 0241

HMFD 1304

duplicated line number were the target of a GOTO or GOSUB.

Apart from its sluggish performance, my main criticism of the 1541 disk drive is the cumbersome command structure used to carry out routine tasks like deleting files or discovering exactly which DOS error has occurred. The DISK command takes care of opening and closing the appropriate channels, leaving you to specify the disk function itself. For example, to delete a file called OLDGAME you enter

DISK"SO:OLDGAME"

Reading the error channel is even easier — you simply type DISK" and up pops the error code.

I never understood why it should be necessary to destroy the program in memory in order to see a disk directory. Well, with TFC it isn't. CATALOG displays the directory without disturbing your program, and it's a far more sensible command anyway. Actually, given the number of shortcomings that are avoided by TFC and other products, it's amazing that the C64 ever became as popular as it did. I suppose the positive side is that it has allowed a number of small businesses to make a buck by filling the gaps and correcting the mistakes.

The tape turbo purports to make all the tape commands operate ten times faster. While there seems to be some variation according to the exact circumstances, the claim is about right. The only extra tape command is APPEND, which is simply the tape equivalent of DAPPEND.

Printer Interface

Essentially, TFC turns the C64's user port into a Centronics interface. Naturally, this calls for a special cable which was not supplied with the cartridge. To make things worse, the pin connections are not described in the manual, so it would be difficult to produce a home made cable. The section of the manual dealing with the printer interface is far from satisfactory. For example, it claims that high-resolution graphics dumps are possible if the printer has a bit-map mode. Not all printers handle bit-maps in the same way, but there is no indication of which printers will work with TFC. On the other hand, we are told that when opening the printer channel, secondary address 0 should only be used with an MPS 803 printer, but there is no indication of its effect.

Given the apparent quality of the rest of TFC, the printer interface probably works very well. If the interface were an important feature to a prospective buyer, I would advise him or her to insist on a clear-cut assurance of its suitability for use with any particular printer before purchase.

Machine Language Monitor

Generally speaking, a monitor is an unexciting piece of software. It's practically essential if you want to mess around at the level of machine code, but you'll never impress the neighbours with it. The monitor tucked inside TFC includes most of the commands I consider mandatory in such a program, and some that are very desirable. There are some important omissions, though.

First, the basics: the MONITOR command transfers control from Basic to the monitor, where you can do things like examining the contents of registers and memory, or executing programs. Most monitors will convert the instructions in memory to the equivalent mnemonics — TFC is no exception, but in addition to the disassembler it also provides a mini-assembler which allows you to enter a program in mnemonic form. I once tried hand-assembling a short piece of code, but decided that some kind of assembler was a must, even for short routines. Further commands allow the saving of areas of memory to tape or disk for later reloading.

There are a number of frills, such as the commands to move a block of memory from one place to another, to fill a block with a particular value, and to compare the contents of two blocks. The hex to decimal to hex converter could be useful, as some of the addresses and values in Commodore's documentation are given only in decimal (presumably because of an assumption that all programming would be done in Basic). I only found one error in the manual, and that was related to this feature. All signs were printed as £ signs, and # is the decimal to hex conversion command.

Unfortunately, there are two major shortcomings. Bear in mind that the term "monitor" is used as such a tool is supposed to let the programmer monitor the execution of a piece of code. The facilities that allow this are breakpoints and tracing, but they are both missing from TFC. A good monitor should allow the user to specify breakpoints at certain places in a program at which control returns to the monitor, so that the contents of the registers and appropriate memory locations can be checked. Essentially, tracing

involves the automatic insertion of a breakpoint after each instruction. While tracing and breakpointing can be carried out manually with this monitor, it would soon become tedious in the extreme.

A command is provided to switch the system's ROMs in and out of the memory map, giving access to the portion of RAM that is usually hidden. The form of the command is somewhat odd: 04 for RAM, and 07 for ROM. Humm . . .

Miscellaneous

TFC makes a few changes to the C64 keyboard. The eight function keys are loaded with the following commands: LIST, MONITOR, RUN, OFF, DLOAD, DSAVE, CATALOG, and DISK. Of these, OFF is the only one that has not been described (apart from the normal Basic commands). Its effect is to disable all of TFC's commands, presumably in case of a conflict with another piece of software. The disk and tape turbos, and the printer interface remain active until turned off by means of a toggle switch mounted on the cartridge.

Other keyboard-related features are that text scrolling stops while the control key is depressed; control-home moves the cursor to the bottom left corner; and control-delete erases characters from the cursor position to the end of the line. Nothing earth-shattering, but definitely useful.

The TYPE command apparently simulates an electronic typewriter. When a printer is attached to the Centronics interface, TYPE buffers keystrokes (which may be edited in the normal way) until the return key is pressed, whereupon the line is sent to the printer.

Now we come to what struck me as being the only original idea in the package: the MR and MW commands. They stand for memory read and memory write, and provide an easy way of making use of the 64's 'hidden' memory. MR and MW transfer 192 bytes of information between the tape buffer and a user-specified area of memory. For example, a program might "save" a screenful of information by repeated use of MR and MW, in order to re-display it after showing some other information. These commands might also be useful for storing large amounts of text, allowing the messages to be displayed much more quickly than if they had to be read from disk each time.

The remaining Basic enhancements are the ability to use hexadecimal constants (by prefixing them with $ signs), and changes to the LIST command to overcome attempts to prevent LISTing.

The only suggested use for the reset button is in conjunction with copy-protected software: "All protected programs will reset to the monitor using this method". Now why would anyone want to do that? Of course, there are legitimate uses, especially while debugging machine-code routines.

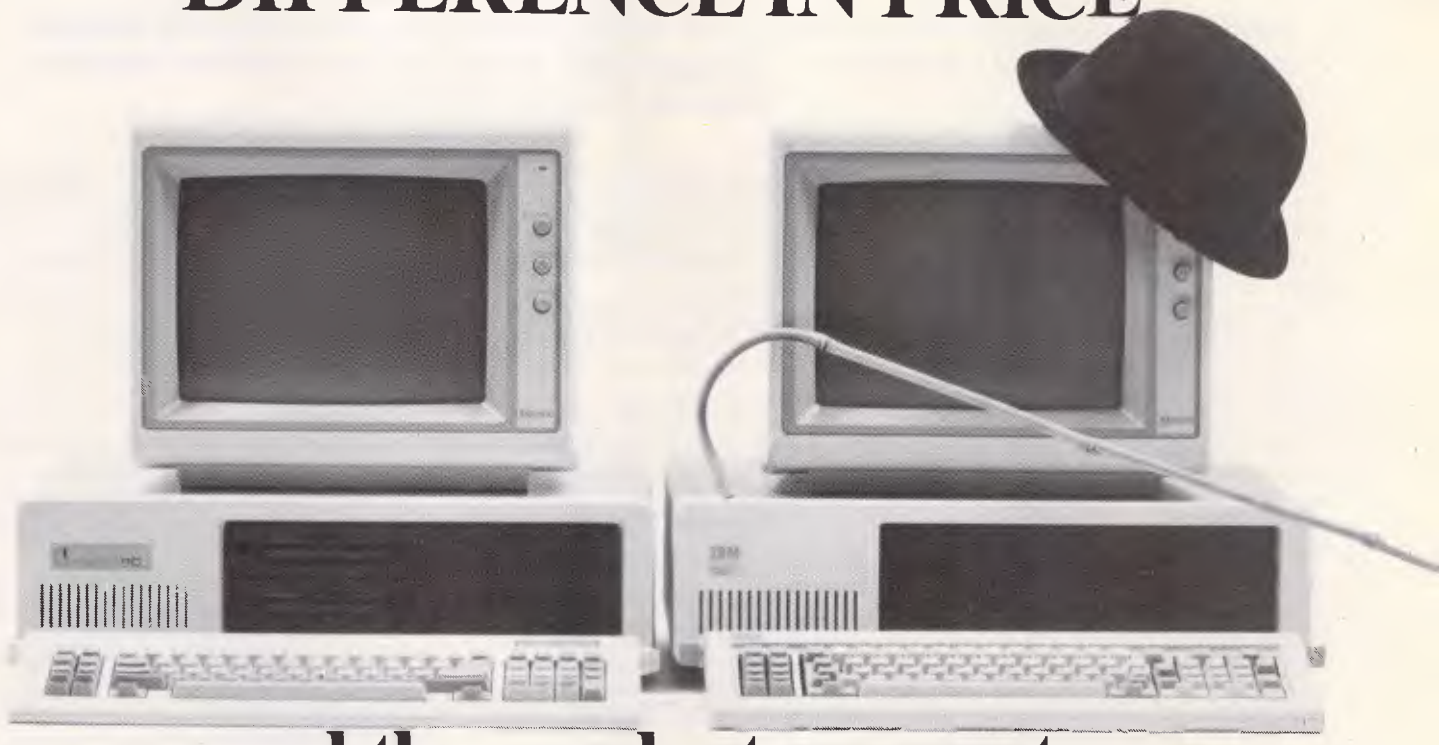
Conclusions

The main problem with TFC is the $159 price. I've been using an Epyx Fast Load cartridge for several months, and for about a quarter of the price of TFC it gives similar disk performance and commands, extra disk utilities, and a comparable monitor (it traces, but lacks the mini-assembler). Assuming you're not interested in the tape commands, that leaves $120 to cover the cost of the printer interface and toolkit commands. I believe the question comes down to determining whether you are likely to use all of TFC's features. If so, it seems to work and is quite well documented; otherwise you could probably save money by picking a suitable combination of other products.

The Final Cartridge retails for $159 and is distributed by Pactronics. Tel: 630 8555.

END

SINCE THERE'S LITTLE DIFFERENCE IN PERFORMANCE YOU SHOULD LOOK FOR THE DIFFERENCE IN PRICE



...and the product warranty

There are a lot of different personal computers available in Australia, many with similar technical features and prices. Now, Chendai would like to introduce you to our fully compatible PC that has all the functionality of the others but is priced from around $1450, and comes with a level of customer support that makes the others envious. Every PC retailed by Chendai is backed by a **DATACRAFT** six month Australia-wide warranty.

So if you want guaranteed reliability and compatibility, as well as saving hundreds of dollars, call us today.

CHENDAI *...funny name, outstanding PCs.*

109 Drummond Street, Carlton, Vic. 3053. Phone: (03) 663 3030.

N.S.W. (02) 85 7540, **W.A.** (09) 227 8952, **S.A.** (08) 45 9820, **A.C.T.** (062) 51 2525.

PC publishing

Traditional methods of typesetting are rapidly undergoing revolutionary change as access to PCs, LaserWriters and pagination software cuts time and expense. John Le Fevre looks at several installations.

The term Desktop Publishing was first used last year by the US publishing industry in an attempt to describe the dramatic effects PCs and laser printers were having on the very ancient craft of typesetting.

In the January edition of *APC* we described the various traditional ways of turning the output of your word processor into print. As described, obtaining printed versions of your work necessitates either a trip to, or from, your local typesetter to have your disks converted to a form of data readable by an expensive typesetting machine.

While this method has been adequate in the past, the time delays, loss of control and costs are far from acceptable to many people.

In the past 12 months an increasing number of corporate, small business and educational users around the world have been moving away from the traditional methods of typesetting to running the whole process in-house.

The result has been an increase in sales of pagination software together with an increase in the number of PCs entering even large corporation offices. A direct consequence of the increasing number of companies and individuals choosing to carry out their work in-house has been the rapid emergence in both the US and Australia of a desktop publishing industry.

The growing number of quality laser printers is also resulting in the task of in-house typesetting becoming more attractive to even small businesses.

How much?

One of the most popular and inexpensive ways to produce your own typeset is with the Apple Macintosh, LaserWriter and good quality pagination software. Now that the price of the 512k Macintosh has dropped to less than $3,500 the initial setup costs total less than $14,000 compared to around $8,000 for the software alone for the IBM PC.

Because of the Mac's ability to easily handle graphics and text, it is placed in a field far above any other PC and is one of the prime reasons desktop publishing is one of the Macintosh's fastest growing vertical markets.

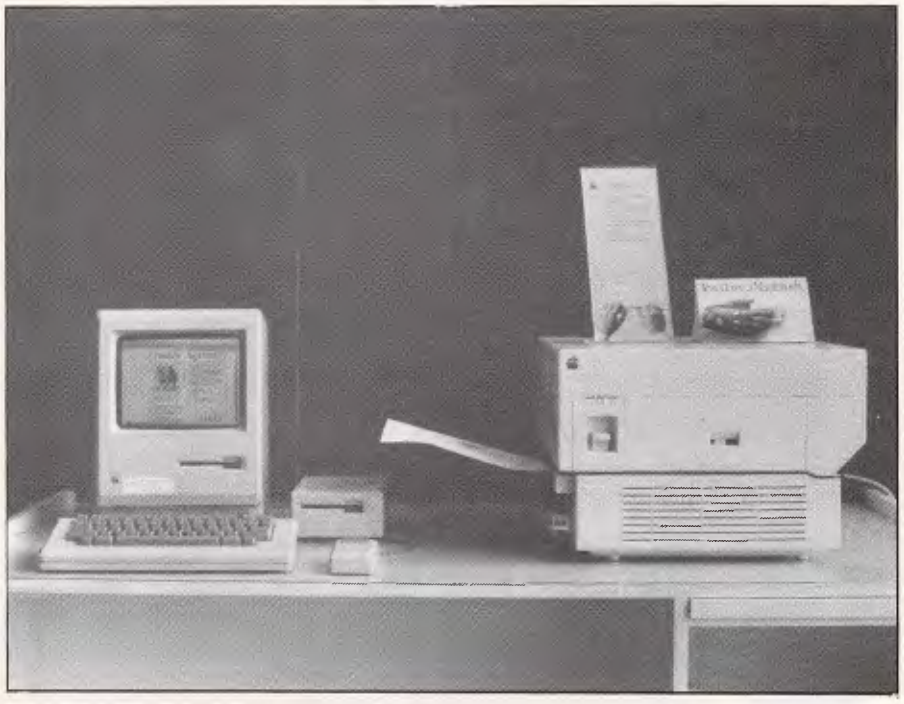
However, the first reaction of many people to the suggestion of sacking their outside typesetter and going it alone is, "we don't do enough to justify the expense".

'One of the most popular and inexpensive ways to produce your own typeset is with the Apple Macintosh, LaserWriter and good quality pagination software...'

Arnold Roth, managing director of Software Corporation of Australia, the company marketing the award-winning software PageMaker, claims he has heard this and similar expressions hundreds of times in the past twelve months and says it simply isn't the case for even small and medium size businesses.

According to Roth, "There are a lot of people today who are in the publishing business and don't know it and I believe there isn't a business in Australia which couldn't use PageMaker. Desktop publishing is a new area of computerisation and an area in which people originally didn't think computers had a role".

While Roth admits the quality of output from the current generation of laser writers isn't sufficient to create pages of type for *Vogue*, (current laser printers can only produce 300 dots to the inch compared to 5000 by some commercial phototypesetting machines) it is suitable for creating type for anything from daily



Apple Macintosh and LaserWriter

newspapers to internal forms.

As an indication of the usefulness of PageMaker, the Macintosh and LaserWriter, SCA creates and publishes all of its press releases, advertisements, brochures and internal stationery on the system and, according to Roth, "is saving between $3,000 and $4,000 a month on typesetting charges".

While the savings alone are substantial, Roth said the control that is maintained over the document is the most important benefit. "The entire documentation for TOUCH was still in draft form five or six days before we had the finished product in our hands. And because we produced the manual in-house we had complete control over the contents of the book up until it went off to the printer. Nothing can buy that sort of control".

For people who find the initial setup costs too high, the alternative is to purchase the Macintosh, external drive and PageMaker software and then utilize one of the bureaux that are emerging to cater for the demand of cheap, good quality typesetting.

One such bureau is Desktop Publishing in Melbourne which began operating in August last year. Kevin Mack, manager of Desktop Publishing, said: "What we are doing with PageMaker is what typesetters were doing with their traditional tools".

If Apple does manage to capture a sizable proportion of the desktop publishing market, the future of the Macintosh is virtually guaranteed and will end a lot of industry criticism that the Mac is an up market, over priced home computer without any corporate future.

Prior to opening the bureau service last year, Kevin managed Big Print, a traditional instant printing business where all of the typesetting was sent outside. He still owns Big Print but now 70% of the typesetting is performed by Desktop Publishing, providing savings in both time and overheads.

Mack claims one of the main benefits of desktop publishing is that it's easy to show customers different options, as opposed to using paste-ups or hand draft. "We have customers sitting at the machine while we do the layouts and if they want something moved a fraction to the left or right it's quite a simple matter," he said.

According to Mack this control of layout can easily save between three or four trips to the typesetter and gives the client more options on how the finished product is going to look.

While the current generation of laser printers only provides 300 dots to the inch there are rumors of a 600 dot to the inch printer being released by Apple later this year. Mack claims it is possible to improve the quality now: "If you create your text twice as large as you require it in the finished product, and then reduce it by 50% you end up with 600 dots to the inch, and that is quite good quality".

While bureaux such as Desktop Publishing provide an inexpensive way for people to first tackle in-house typesetting, the technology is also allowing printers such as Mack's Big Print to "react faster to clients demands and become more competitive" in the cut throat area of instant printing.

Corporate affairs

The capabilities provided by desktop publishing are already starting to be seen by Australian companies, and the Shell corporation is no exception.

A Shell spokesman said they had recently installed a Macintosh and LaserWriter in the communications department to cater for in-house publications and simple documents of up to four A4 pages.

The decision to purchase the Macintosh wasn't seen by the company as a major event as they currently use many other brands of PCs. The company spokesman said Shell "needed the ability to present information in various fonts, styles and graphics which the Macintosh provides and the logical combination was a laser printer and a good pagination software package.

For the past two months Shell has been using PageMaker and according to the spokesman, "the prime consideration is the quality and control of material being produced rather than any cost savings. Though as a private company, these too play some role".

According to Shell, desktop publishing has opened up a new avenue for corporations and businesses in general and provides another communications tool for industry.

Another area where desktop publishing is carving a niche for itself is the electronic publishing business where video-

Dac Easy Accounting

Highly Acclaimed

$333

Dac Easy Gives You Seven Full Feature Accounting Modules In A Single Integrated Package.

Accounting software doesn't have to be expensive to be the best. Dac Easy gives you a fully integrated accounting system with instant access to General Ledger, Accounts Receivable, Accounts Payable, Inventory, Purchase Order, Billing and Forecasting. Imagine, you can generate over 300 reports from 80 different routines . . . all in a non copy-protected package. And, with Dac Easy you'll get a handsome slipcase binder with easy-to-follow documentation. Best of all, Dac Easy Accounting can be used to manage either service or product oriented businesses.

Find out for yourself why Dac Easy is the fastest selling accounting package on the market. Compare Dac Easy's features against other packages costing thousands more. Then, order your Dac Easy Accounting by calling our number or returning the coupon below.

General Information
- Menu driven
- Password protection
- File capacity limited only by disk space
- Support contract available

General ledger
- Unlimited # of accounts with multi-level accounting, unlimited departments
- 3 year account history for CRT inquiry
- Pencil and pen feature to correct mistakes without reverse entries
- Unique budgeting routine (see Forecasting)
- CRT transaction inquiry, unlimited journals
- Activity report, trial balance, financial statements, etc.

Accounts Receivable
- Open invoice or balance forward
- 7 customised columns for aging report
- Unlimited # of customers
- Mailing labels and directories with 4 different sorts
- Automatic finance charges
- Supports partial payments
- 3 year customer history for # of invoices, sales, costs, and profits
- Customised text on statements
- Cash flow analysis
- Sales analysis
- Automatic sales forecasting by customer, salesperson or customer type

Accounts Payable
- Check printing and up to 10 invoices paid per check
- Automatic allocation of available cash to payables
- Vendor directories with sorting by vendor code, name, or territory
- Aging reports with 7 customised columns
- Unlimited # of vendors
- Mailing labels with 4 different sorts
- 3 year vendor history for CRT inquiry and printing
- Flexible payment calendar
- Automatic forecasting of purchases
- Unlimited allocations per invoice

Inventory
- Supports average, last purchase, and standard costing methods
- Powerful physical inventory routines
- Accepts any unit of measure like fractions/dozens/gross/hours/minutes, etc.
- Automatic changing of costing methods
- Time and product inventory
- 3 year product history in units, dollars, cost and profits
- Automatic forecast of product sales
- Automatic pricing assignments
- Alert and activity reports with 11 sorts
- CRT shows on-hand/on-order/committed/sales/cost/profit/turns/GROI

Purchase Order
- Usable for inventory and non-inventory items
- Allows up to 99 lines per purchase order
- Per line discount in %
- Purchase order accepts generic discounts/freight/taxes/insurance
- Purchase Order accepts back orders and returns
- Purchase journal
- Automatic interfacing with General Ledger, Payables and Inventory

Billing
- Invoicing on plain or pre-printed forms
- Prints sales journal
- Automatic updating of committed products in inventory
- Ability to customise invoice for remarks
- Allows return credit memo
- Interfaces with Inventory, Accounts Receivable and General Ledger

Forecasting
Unique program that automatically forecasts using your 3 year history
- Forecast revenue and expense accounts
- Forecast vendor purchases
- Forecast customer sales, cost, and profit by customer or salesperson
- Forecast inventory item usage by 4 automatic methods
- Forecast by same as last year, or % base from last year or trend, or least square trend line analysis method

Minimum Hardware Requirements:
IBM (PCjr, PC, XT or AT)[1] or other compatibles, 128K memory, one 5¼ DSDD floppy disk, 132 column printer in compressed mode, 80X24 CRT, MS-DOS[2], PC DOS[1] 2.0 or later

[1] Trademarks of International Business Machines. [2] Trademark of Microsoft Corporation.

distributed and supported by

insystems

we make computers work for you.

337 MORAY STREET,
SOUTH MELBOURNE, VICTORIA 3205
44 MILLER STREET,
NORTH SYDNEY, NSW 2060
PHONE: (02) 957 5729

(03) 690 2899

INSYSTEMS PTY LTD
337 MORAY STREET, SOUTH MELBOURNE 3205

ENCLOSED IS OUR PAYMENT OF $333, PLUS $7 P & P.
PLEASE SEND ME A COPY OF DAC-EASY ACCOUNTING SOFTWARE:

I enclose my cheque for $ _____ or please debit my American Express, Diners Club, Visa Mastercard or Bankcard.

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Card Expires _____ Signature _____

Name _____

Address _____

_____ Postcode _____

Phone Number _____

30-DAY MONEY-BACK GUARANTEE. **INSYSTEMS** PROVIDE A 30-DAY MONEY BACK GUARANTEE.

tex style databases can provide soft copy as well as professional quality hard copy.

Teledata Network is one example of the successful marriage of both forms of publishing and according to David Franklin, the president of Teledata Network, consumers can now have the best of both worlds.

Teledata currently uses two Macintoshes and a 10 Mbyte and 20 Mbyte Hyperdrive for its fully integrated electronic mail and local and international telex service which has in excess of 2,500 customers. Coming from a phototypesetting background, Franklin is in a perfect position to comment on the quality currently available from laser printers and pagination software such as PageMaker. And he says the results represent "excellent value for money".

"It's not purist typesetting, and a professional typesetter would hold a magnifying glass over the finished product and freak out over the size of the dots, but for the majority of people it is more than adequate. There are still a few problems to be addressed like hyphenation, justification and kerning, but future upgrades should address these problems, and in about four to five months time the software should be as good as that used in phototypesetting".

"The benefits at the moment are that it is so much cheaper than traditional typesetting and the turn around time and control is a major step forward over traditional methods," he added.

According to Franklin, anyone with a bit of flair with PCs and some patience will do quite well with PageMaker and the Macintosh which, "is the perfect computer for the casual computer user. For someone who doesn't like reading manuals to learn different applications and wants a rapid learning curve it is without peer," he added.

Franklin said quite a few people have already come to realise the benefits to be gained from both electronic publishing as well as the ability to provide professionally laid out hard copy. "We have customers who upload to us at either 200, 1200 or 1200/75 baud rates for electronic publication and who also require a hard copy to be distributed. We use PageMaker and the LaserWriter for the final compositions," he added.

Franklin said desktop publishing was certainly going to have a great impact on the way even small companies prepare their internal and external documents and described the future of the industry as 'booming'. It's certainly changed the face of the publishing industry and results are less paper being moved around and more efficient operations".

"The whole area represents especially good value to both small and large businesses which put out occasional publications, technical notes or in-house journals as well as the professional newsletter publishers. Figures I've seen from the USA are predicting the business to develop into a $5 billion market and over there desktop publishing is predicted to be one of the biggest growth areas in computerisation," he added.

The desktop publishing industry is also appealing to Apple computers and 1986 is seen as the year when the company will make a concerted effort to get a stranglehold on the industry. The attack on this vertical market is one of the prime battle plans in 1986 for the company and is expected to start heavy mass media advertising very shortly in an attempt to sew up as much of the market as possible before less expensive pagination software becomes available for the IBM PC."

'These are the same people who claim governments are wasting the public's money, but when an issue such as this arises the first thing they do is black ban it and everyone loses out.'

Already there is talk of an IBM version of PageMaker nearing completion, and with the release of Windows by Microsoft last month, the task of creating professional quality documents on Big Blue's machine is getting closer all the time.

If Apple does manage to capture a sizeable proportion of the desktop publishing market, the future of the Macintosh is virtually guaranteed and will end a lot of industry criticism that the Mac is an up market, overpriced home computer without any corporate future.

Already SCA and Apple are gearing up toward a joint advertising campaign to stress the ease and versatility of the two products together. And the only real battle facing penetration into the large corporate offices is to dispel the myth that IBM is the only road through the forest.

With the expected announcement later this year of a 600 line to the inch LaserWriter, giving the ability to produce

PC TEX TYPESETTING PROGRAM

FOR IBM PCS AND COMPATIBLES

What is TEX?

TEX is a comprehensive typesetting program which has been running on mainframe computers since 1978. It is now available from THE WORDWORKS to run on the IBM PC, PC-compatibles and other MS DOS machines. (Incidentally, TEX is pronounced 'teck'. That's because the 'X' is really the Greek letter *chi*.)

What Kind of Typesetting Can TEX do?

Anything from complex scientific textbooks ($\int_1^x \frac{dt}{t} = \ln x$) to wedding announcements to multi-column newspaper layouts.[1]

What Hardware Is Required to Run TEX?

An IBM PC or compatible with a 10 (a squeeze!) or 20 megabyte hard disk and 512K or (preferably) 640K of RAM. THE WORDWORKS will happily supply these items.

What Kind of Printers Does TEX Support?

It gives true typesetting quality on the IMPACT 800-II LASER PRINTER, or on a Hewlett-Packard Laserjet printer upgraded with an IMPACT board from THE WORDWORKS. *(This ad was typeset with TEX and an IMPACT LASER PRINTER.)*

It gives quite good (e.g., club newsletter) quality output on the TOSHIBA 1340 & 1351 24-pin dot matrix printers; and does a reasonable job with Epson MX/FX or compatible printers. However, with matrix printers character-borders are faintly 'dotty'.

Is TEX Hard to Learn?

Learning the functional basics of TEX is no harder than learning a good word processing program. Beyond that you can go as complex as you like—TEX is a very powerful and versatile tool.

Is TEX a Word Processing Program?

No. You use a normal word processing program for preparing your text; then you convert your text files into standard ASCII files (most good wp programs allow you to do this easily); after which you process these ASCII files with the TEX program, and get a DVI (i.e., Device Independent) file. Finally you send this DVI file to your printer. (TEX files can be transferred between mainframe computers and PCs for editing or printing.)

Can One View One's TEX Output on Screen As It Will Appear on Paper?

Yes, with the optional PREVIEW program—provided you have a Hercules graphics card or equivalent and a 720x400 pixel monitor. THE WORDWORKS can provide these.

PC TEX $450

Printer Drivers: Epson FX/RX **$175**; Epson LQ1500 **$175**; Toshiba 1340/1351 **$175**; Impact Laser 800 Printer—**POA**.

[1] By the way, TEX does automatic footnotes, indexes and tables of contents.

THE WORDWORKS, The Boulevard Lawns, City Walk, Canberra City ACT 2601. Telephone (062) 572893; (062) 477739.

typeset of 1200 lines to the inch, the task ahead for the two might not be so daunting.

Union Pressure

Union pressure from the Printers and Kindred Industries Union, PKIU, is slowing introduction of desktop publishing and typesetting in many state and federal government departments. The union argues that members are losing work because of the new technology and in some locations have declared typeset and layout produced with laser printers as black.

However, the union is not getting it all its own way. In several departments the argument has been successfully put that the work being prepared on the laser printer would not have normally been carried out in the past. As a form of peace offering, government departments argue further that the new technology is in fact creating jobs due to the fact that more circulars, newsletters and such are now being created and are being printed by departmental printers.

In some locations this argument has succeeded while others are still running into problems getting in-house material printed. The hard line stance by some PKIU members is causing more than one senior public servant to squirm, and one who asked not to be named described the union's actions as "mercenary".

"In our department alone we've estimated we could increase the variety and number of publications by around 30% as a result of this new technology without dramatically increasing our overheads, but union bans are stopping us. These are the same people who claim governments are wasting the public's money, but when an issue such as this arises the first thing they do is black ban it and everyone loses out," he claimed.

However, the PKIU doesn't see the issue as cut and dried as that. Ian Wenham, Victorian State Secretary of the PKIU, said the union had a long standing policy of banning any typesetting that could not be identified as coming from a recognised trade house.

"Jobs are being lost due to attrition and we are concerned at high technology and the loss of jobs that occurs, but this has been happening for about the last ten years with the introduction of computer-based typesetting. I'm sure some entrepreneurs will install this equipment and try to circumvent the traditional methods, and it will have some impact on job opportunities in the future," he added.

However, according to Wenham, the federal council of the PKIU will be looking at the problems of desktop publishing at their council meeting in Sydney next month and "addressing the issue nationally as a union".

While the PKIU maintains that good quality typesetting only comes from people who are trained in the craft, the fact is that a lot of the material currently being prepared by typesetting houses does not require the quality, should not incur the prices charged, and can easily be produced in-house at substantial savings to industry.

With such a large amount of interest generated already in the technology overseas, the future of this rapidly rising vertical market looks assured with the only retarding influence being the output resolution of current laser printers. END

Where can I find an integrated package that combines the features and power of the programs I already own?

What if I can't use my old files with the new software?

What will I do with the programs I use today if I buy integrated software tomorrow?

Will I have to spend yet more time and money learning something completely different?

The Snapshot Shuttle. The shortest distance between your favourite programs.

If only there were an alternative to integrated software!

You've probably considered the benefits of buying a program that does several different jobs from one disk. After all, most computer users need to switch from one task to another several times a day. And repeatedly closing down your current program, booting a different disk and then trying to find where you left off wastes valuable time and disrupts your flow of work.

Integrated software would be the obvious solution if it weren't for the fact that one Apple II user is likely to have very different needs from another.

The remarkable Snapshot Shuttle™ is an expensive device that gives you a simple alternative to worrying about the drawbacks of integration. It lets you keep up to four different programs in memory at any one time.

You want to combine the best word-processor with the fastest spreadsheet, a versatile comms package and Hitch Hikers Guide to the Galaxy?** Fine. With the Shuttle you're free to choose.

You can switch rapidly between your programs with just the flip of a switch, and each one resumes running exactly where it was interrupted. No fuss, no waiting. The Shuttle even works happily with integrated software!

You already know everything you need to know to use the Shuttle. There are no new commands for you to memorize and no piles of impenetrable documentation to wade through. And because it uses the interrupt-and-resume power of the Snapshot card, the Shuttle gives you access to a whole new world of great, easy-to-use utilities that will enhance your Apple at home and in the office.

PRICES

Shuttle software and Snapshot card	$245
+1 other Snapshot software pack	$277
+2 other Snapshot software packs	$298
+3 other Snapshot software packs	$319
(Snapshot software packs are available separately at	$45

SYSTEM REQUIREMENTS
Apple II+ or //e with minimum 128K RAM and 1 disk drive.

MEMORY EXPANSION CARDS
The Shuttle will let you load 2 x 64K programs into a 128K Apple. Naturally, the more memory you have, the more programs you will be able to load. The Shuttle works with all the popular RAM cards including Apple's new Memory Expansion Card.
C.R.L. 64K extended //e 80-column card $99

ORDER FORM

Send this completed form to the sole Australian Distributor:—

Cybernetic Research Limited
4th Floor, 464 St. Kilda Road,
Melbourne Vic. 3004.
Tel: (03) 267 8888
Tlx: 39741 ASIPAC
Fax: (03) 267 4981

MasterCard VISA bankcard welcome here

Payments can be by cheque or all major credit cards

NAME: .....

ADDRESS: .....

..... POSTCODE: .....

Please send information only ☐

Please supply: _____ $
_____ $
_____ $

Card No: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Expires: / /8

Computer type: .....

SCREENTEST

The Word Machine

Ideas processing — the use of a machine to order your thoughts in a tree structure — is one of the new possibilities opened up by the widespread use of micros. Phil Cohen takes a look at an Australian-designed ideas processing package.

First I'd like to say that it's nice to be able to review a piece of Australian software. Troll Microsoftware, developer of The Word Machine, is based in ACT, and says that its next product will be an educational package for teaching artificial intelligence principles, which is due in the middle of this year.

The Word Machine is an ideas processor, a piece of software which lets you order your ideas in a sort of tree structure on the screen. We've all done that sort of thing on paper — prepared a shopping list, for example, with main headings and subheadings:

1 Bank
  New chequebook
  Deposit cheques
    Wages
    Tax rebate
2 Camera shop
  Ask about repairs
    On SLR
    On box brownie
  Buy filter
  Pay bill
3 Supermarket
  Check closing time
  Do shopping

The Word Machine lets you do that sort of 'hierarchical' organisation with a good deal more flexibility than a pencil and paper, and lets you store your ideas on disk. It can also handle subheadings down to any level, and allows you to add text to the headings at any level. Most importantly, it lets you 'move' through the document easily on screen.

Rather than show the whole document at one time, The Word Machine shows on screen all of the headings of a particular level, so that in the above example the first screen would look like this:

1 Bank
2 Camera shop
3 Supermarket

Selecting the first heading would make the screen show:

Bank
1 New chequebook
2 Deposit cheques

The main use for The Word Machine will probably be in drafting documents of various sorts — speeches, manuals, etc. By putting down the main headings, then subheadings under those headings and so on, and then filling in the text at the lowest level, you can in theory build up the document in a logical sequence painlessly.

I say 'in theory' because as a professional writer I find the results of this sort of approach generally very poor — choppy and therefore difficult to read.

I say 'in theory' because as a professional writer I find the results of this sort of approach generally very poor — choppy and therefore difficult to read. However, some people swear by the hierarchical method and it does at least ensure that all of the facts end up on paper.

I found operation of The Word Machine quite difficult. It's written for the Apple, and since my review machine was an Apple II+ with a Vision-80 card I had only two cursor control keys — the right and left arrows — so that movement up and down had to be accomplished by using the space bar to change the function of the keys. I think a WordStar approach (using a 'diamond' of QWERTY keys) would have been a lot easier.

Slow

The software is also incredibly slow. When entering text, I could out-type it very easily, which would be frustrating if I was trying to get my thoughts down quickly. This slowness may in part be due to the text compression system used. Text compression also means that you can't move back to the last word you typed in order to make corrections to it (you have to replace the word entirely). The whole process of entering information into The Word Machine is frustrating and slow.

Once it is in there, however, moving about in the document is fairly easy. Pressing the ESCAPE key takes you 'out' a level, and pressing one of the number keys selects one of the headings present on the screen for 'expansion' to show all of the subheadings under it. Unfor-

tunately, selection of a heading by this method is limited under most circumstances to the first 10 lines on the screen — a disappointing limitation.

A powerful 'clip and paste' approach is taken to deletion and moving of headings and their associated sub-headings and text, and you can have as many windows on the screen as you like, each showing a different part of the document.

Some headings have what Troll for some reason calls 'hyperspace jumps' embedded in them that take you to another part of the document altogether when you try to expand them. This feature, although nice in theory, makes it very easy to get completely lost in a document.

Working with the package, I came slowly to the conclusion that the mistake Troll had made must have been to miss out that all-important step in package development: the field test. There are so many little faults embedded in the software that it's obvious that it's never been used seriously by someone not committed to the product.

For example, trying to type a capital 'P' while entering text sends a control code which stops text entry! Also, you can't re-read your document from disk, losing what you have done so far that session — something I found myself wanting to do quite often.

The documentation for the package is an excellent example of the sort of thing a hierarchical approach might produce. It is almost impossible to follow on a first reading, and chock full of both repetition and cross-references even though it is only just over 60 pages long.

A good deal of confusion has gone into naming, for example: "The status of a line is further indicated by the Reference Line. This consists of three symbols."

What they're trying to say is that a symbol at the start of each line shows its status; that there are three possible symbols. The 'Reference Line' they're talking about is actually a column. Confusing, isn't it?

Another little gem is calling the directory a 'dictionary' consistently, even in messages from the software.

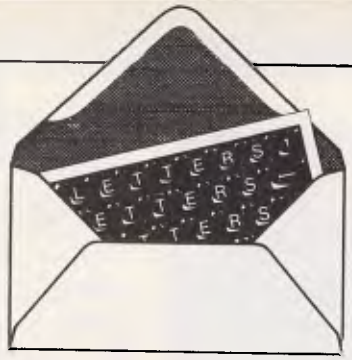
Conclusion

On the whole, The Word Machine is so difficult to use that most people will revert to pencil and paper methods. Or at the very least they will turn to a decent word processor, which can do many of the things The Word Machine can do, and type letters too. However, at $85 some people may think it worth buying just to play with.

I'm sorry to have to come down so heavily on this little package, but I hope that Troll will learn from their mistakes and that its next product, The Inference Engine, will be properly field-tested.

The Word Machine is available from: Troll Microsoftware, PO Box 21, Lyneham ACT 2602. Phone: (062) 47 2924.

END



LETTERS

This is the chance to air your views — mail to 'Letters', Australian Personal Computer, 2nd floor, 215 Clarence Street, Sydney 2000. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

From here . . .

Mr Walls is misleading himself in the problems he set concerning the difference between two infinite series. Mathematically, any infinite series of positive numbers — for example, all positive odd numbers, all positive even numbers — add up to infinity, (the same infinity!), so the difference between the two such series is zero.

What he has done by taking the difference between corresponding terms in each series is simply create a new infinite series, which as before adds up to infinity. If the differences between terms are all positive, then their sum is plus infinity. If the differences are all negative, then their sum is minus infinity.

Mr Walls is treating infinity as if it were just like any ordinary number, only bigger. As an engineer, my definition of infinity is that it is a number which is so big that the differences between the sums of, say, all odd numbers and of all even numbers is negligible in proportion to the actual sums. In mathematics, one doesn't care what the actual value is, and so just uses the familiar symbol ∞

D Jacobs

. . . to infinity

Your correspondent Colin Walls (January, *APC*) has gone the long way round in proving that infinity is a tricky concept. Here is a simple experiment that you can perform in your own living room which requires no mathematics at all.

First imagine a straight line passing through the room and extending to infinity in both directions. Obviously and intuitively this line is infinite in length. Now divide the line in two by extending your forefinger and placing it on a point on the line. Erase a half inch section of the line at that point.

You now have two lines, each of them extending to infinity in one direction. Obviously each line is still infinite in length, but intuition has become confused. Can you really divide infinity in half and still have infinity, or rather two infinities? Does this mean that dividing infinity is the same as multiplying it? Put it another way, can you really subtract infinity (say, the left half of the line) from infinity (the original line) and still have infinity left over?

Wherever you divide the line, the two halves must be of equal (infinite) length; therefore, your living room is in the exact centre of the universe. Oddly enough, so was mine when I tried this out a while back. Perhaps the centre of the universe moves around a lot.

Those with advanced intuitions may like to try to divide infinity into three infinite parts. All you have to do is walk down the line in either direction for an infinite distance and make another break in the line.

It seems to me that I remember someone (Asimov?) going on about the types of infinity in an old SF magazine. Apparently the more abtruse mathematicians believe in three intensities of infinity, Aleph Null, Aleph One, and Aleph Two. Of these, Aleph Two is the most infinite; if your intuition can handle that.

I Davidson

Don't throw it

Recently I acquired an ancient (venerable) computer, which was, in fact, saved from the tip. It is an NCR 7200 Data Terminal (made in 1976). I am told that it works, but unfortunately there is a problem. You see, the cable from the keyboard to the computer has been cut and I, being from the humble world of home computers, know very little about it.

I do know though, that the keyboard connects via a 25 pin plug (which I have bought). I do not have a manual for it but I need to know which wires go to which pin in the connection.

If it helps, the numbers on the back are these:
Class No. 7200
Model No. 0103-4300
Serial No. 02-11356966
Tracer No. 12317

If I can find something about this by somebody who knows about it I would be eternally grateful. On the other hand, I could always chuck it.

K Hahn

Would any readers who have info to stop K Hahn chucking immediately write to him at PO Box 10, Sth Kempsey, 2440.

Common problem

On behalf of the members of the Commodore 64 User's Group, I have been requested to contact you regarding your publication.

Our members are expressing concern as to the general unreadability of listings published for the Commodore 64. This is usually due to the size of the type used, but also on occasions the type is smudged or partly missing so as to make the listings very indistinct.

The quality of the programs has on occasions been of great value to our members, but they are finding it more difficult to type them in. We realise that all listings are now available for downloading from Microtex 666, but the majority of members are, at the present time, without modems.

Having bought every issue of your magazine since inception, and having typed most programs in (PET, VIC-20, Commodore 64), I must generally agree with the complaints that we have received. A lot of the early PET programs had lines missing, or were of poor print quality and a lot of time and effort was employed hacking away trying to make them work. Still, this was half the fun of typing them in, and your publication was not the only one to have such problems.

But with the advent of later machines, and the 'spoon-fed programmers' that it created, we must now advance to help them fully understand the machines which they have bought. This is the aim of our User Group, and one of the main reasons that it was formed.

Although our members agree that your publication is one of the best available, they are now unwilling to purchase unless the standard is improved. When compared with overseas publications to which most subscribe they are concerned that an Australian publication cannot match or better the overseas product.

F Martin

COMPAK

Compak Computer Centre PTY. LTD.

156 Martin Street, Gardenvale, Vic. 3185
Telephone (03) 596 7222 Fax 5970126
Telex AA 38029 Quote Ref 841203 A B YEAS

Compak Software Pledge:

Customers are free to return the computer for full refund in the first four weeks after purchase if they show the original disk of any commercially distributed program that runs on the IBM PC/XT and that cannot run on the Z-Nix PC/XT.

(Please note that programmes that use basic need to operate under GW Basic.)

Z-Nix PC/XT with all specifications above — **$1649** *inc tax*

Optional Turbo board to give 40% faster computer than IBM PC/XT — **$75** *inc tax*

20 megabyte hard disk — Tandon slimline — **$1450** *inc tax*

10 megabyte hard disk — Davong — **$925** *inc tax*

Technical Advantages

The latest version of the Z-Nix PC/XT also offers technical enhancements that include dual speed operation. With the purchase of an optional turbo board costing $75 inc tax it will run 40% faster than the IBM PC/XT!

Specifications:

* 640k on motherboard
* Twin 360k drives
* 8 slots
* Multi-function card
* Video card with colour/mono outputs
* RGB colour
* RS232 serial (second port optional)
* Security key to stop unauthorised access
* Front reset button
* Parallel printer port
* Joystick port
* Light pen port
* Battery backed up clock
* Hinged lid for easy access
* Sculpted ergonomic keyboard
* 4 layer board for reliability

LETTERS

We disagree with nothing you have said. It is true that we have had, and continue to have, difficulties with Commodore 64 listings. The problem stems mainly from the difficulty of reproducing the reversed characters so common in Commodore listings. A major improvement can be affected by C64 submissions first being processed by the Commodore Brackets program (p76, November '84 APC) which replaces the reversed characters with abbreviations of the graphic controls within brackets. A copy of this program can be obtained by writing to The Editor, APC, 2nd floor, 215 Clarence Street, Sydney 2000.

Any readers having problems with last month's Commodore 64 Program Editor should also write to the Editor for a more legible copy of the listing.

Competence questioned

I was both amazed and disgusted to read David Taylors' review of the book, "Microcomputer Interfacing". (Chips off the Monolithic Block, Bibliofile, *APC*, January 1986).

Mr Taylor challenges the books author regarding the claim to fame of Jack Kilby and Robert Noyce. Anyone with even a small appreciation for the development of the microchip would certainly know of these two men and would undoubtedly agree that recognition for their contribution was certainly warranted.

It is obvious that David Taylor has not had a thorough upbringing in the computer industry. I suggest that he limit his reviews to books such as "The Hackers Handbook", and leaves the serious side of this industry to people who know what they are talking about.

S Arnfield

Half the story

I am writing in reference to Brian Heywood's fascinating article in the January issue, regarding requirements and sample coding for a real-time operating system for microcomputers.

Certainly Mr Heywood has the right experience to undertake such a task, as evidenced by his lucid and comprehensive analysis of the subject, however I beg to propose that you have published only half an article — what's lacking, other than specifics of a suitable micro environment, is any sort of introduction to the hardware and interfacing techniques for this type of project!

It seems that there is a growing interest in real-time control among micro users, yet there doesn't seem to be a corresponding awakening among hardware designers and manufacturers for provision of suitable equipment. Many users are able to attach a parallel port to one or more relays and affect control of simplified environments such as model railways, however it somehow doesn't seem practical to require one's house, not to mention the number of parallel ports required, to service the profusion of applicances most of us seem to have.

As far as the wiring goes, a moment's thought will reveal that suitable connections exist in almost every house — the mains wiring. This is a bit dangerous for duffers like myself but can safely be catered for at the design stage, and in fact a range of products specifically intended for domestic real-time control is widely available in the USA, generally under the desig-

nation of "BSR X=10" or similar.

To briefly review the capabilities of these products: essentially they consist of a master unit or controller which is attached to the domestic wiring and a computer, either permanently or during programming, and one or more slave units or modules, which are connected between the mains and the controlled device(s). The control unit, depending on its sophistication, may send control pulses to its slave units at particular times or particular conditions, to switch on/off or vary (typically in 16 steps) the mains power to the slave. Simple and common applications are to turn on the electric hot water service in the morning and turn it off again when everyone's gone for the day, or to switch on an outside security light at sunset and off again at sunrise.

Now this is all very well, and great fun if you live in North America, but it seems that there is no such thing for Australian electricity standards! However, perhaps we may hope for developments in this area, with Australian and European hardware manufacturers coming to recognize the value and interest of mains-power control devices. Possibly the first of these is the NectarRing power-line modem, which has just been announced in Australia.

Thus to my hint, suggestion, desire, query, plea: can we please have something about the hardware to implement real-time control in a domestic environment, can we please?

G Woodman

It's on the drawing board; watch future issues of APC.

Common sense

After designing and implementing computer systems in several countries around the world I can tell you that you can find reasonably good hardware and software everywhere.

On the other hand good maintenance, including spare parts and service, is not so easy to obtain. But the real problem is protecting your data files against power failures.

In the case of IBM for example: the PC XT (with hard disk), is good enough for the needs of most of its users and IBM provides good maintenance support. Then, instead of confusing customers by announcing 'new' (but not necessary 'good' PC models) why not dedicate some effort to helping the users with a power back-up system that will keep the computer working a couple of weeks after a black out and also avoid problems of fluctuating voltages? Why not design a 5¼ floppy disk which is sealed inside a cartridge in order to prevent dust and other problems?

R Vallesoto
Western Samoa

C solutions

I noticed in the letters section of January *APC* a letter form A Segar called Curse on C. I encountered the same problem when I was working on a communications project in C on a small minicomputer running Unix version 5. The problem is actually the mode in which the terminal's tty file is opened. The solution I used was to write my own C functions to perform terminal I/O instead of using the standard getchar and putchar. I called them con__stat, getch and putch. When con__stat is called it attempts to read a character directly from the terminal's tty file and if it succeeds it puts the character in a buffer which can then be retrieved by calling getch. But first the terminal's tty file must be opened with the O__NDELAY flag set to force the read to return immediately instead of waiting for a character to become available. I have included the source code for the functions which should work under Xenix if it's really Unix compatible.

```
#include <sys/termio.h>          /* defines O_NDELAY and O_RDWR */

char cio_buf    /* charater buffer     */
int cio_fd      /* terminals file id. */

int con_stat()
{
     int c;
     c = read(cio_fd,&cio_buf,1);
     return(c);
}

char getch()
{
     return(cio_buf);
}

char putch(ch)
char ch;
{
     cio_buf = ch;
     write(cio_fd,&cio_buf,1);
}

cio_fd = open("/dev/tty",O_RDWR | O_NDELAY);
```

Note: you should read your Unix and Xenix manuals for details about the read, write and open calls as they will tell you about all the options and flags. C programming books won't (can't).

I hope you find this information helpful because it took me some time and experimenting to work it out myself.

S Humphrey

C source code. Refer to 'C solutions'

Putting the case for Pascal

I welcomed RJ Elliot's article, 'Languages' (December 1985 issue). It's about time somebody said what a poor language Basic really is. I was surprised at the similarities between Comal and Pascal, especially when I discovered that Comal was an offshoot of Basic. Being a Pascal user, however, I feel it is my duty to explain some of the nuances of Pascal as described by Mr Elliot.

Firstly, the declaration of all variables in Pascal is a consequence of the good data structuring that Pascal provides. I feel sure that if Comal were to offer a more versatile set of data structures, then it too would have to resort to a similar declaration system. Secondly, the use of semicolons do, in fact, serve a purpose. They are used at the end of an instruction, or a set of instructions (as with begin . . end;). Indeed, I feel that one of the greatest difficulties of writing programs is the use of line numbers. In structured languages these are totally unnecessary, although regrettably they appear in the Comal listing. How many hours have we wasted trying to find errors in programs, only to find that the line numbers are out of order?

On a more general note, I find it strange that people do not recognise where a language ends and an operating system begins. The layout of the Comal program is surely a function of the operating system, not of the language? If this is the case, then full-screen editors provide similar features for any language.

I agree with Mr Elliot, though, that schools should have a representative language — after all, most computer applications nowadays are ones which involve the manipulation of numeric and non-numeric information, a task for which Basic is not ideally suited. Let's hope that Comal (or Pascal) get wider usage in schools.

D Morgan

NOW AVAILABLE FOR IBM PC AT AND COMPATIBLES SINGLE AND MULTIUSER

dBase without dBugs

GET RID OFF THOSE dBASE BUGS

Change immediately to FoxBASE. Stop programming around the limitations and bugs of an outdated program. Don't scrap all your dBase knowledge and applications. Switch to FoxBASE, the 100% bug free, 100% compatible alternative to dBaseII.

4-40 TIMES FASTER

FoxBASE uses superior disk access and memory management to run dBase applications much faster. A virtual program storage technique keeps frequently referenced programs in memory in compiled form.

USE EXISTING DATA AND APPLICATION FILES

While retaining a database which is completely compatible with dBase II, FoxBASE uses state-of-the-art B+ tree indexing to maintain index files. By rebuilding your index files, you can convert an existing database from dBase II to Foxbase. The result is a substantially smaller index file (typically 50% smaller than those needed by dBase II) which can be processed much quicker. Sorting tasks are typically 20 times faster than in dBase II.

FULL PROGRAM SECURITY

FoxBASE compiles your source files to tokenised code. Your applications not only run quicker, they are secure as well.

EASIER TO USE

Unlike dBase, FoxBASE provides extensive help facilities and error checking. This intelligent error checking can even detect tricky "if else end if" and "do while end do" mismatches.

STRONG ON NUMBERS

14 digit numeric precision plus 8087 co-processor support makes sorting and all numeric tasks fast and super accurate. dBase II only provides 12 digit precision.

MORE IMPROVEMENTS

- ❑ 48 fields per record (32 in dBase)
- ❑ Full type ahead buffer
- ❑ Twice as many memory variables
- ❑ Enhanced screen editing facilities

SUPPORTED BY LONG SUFFERING dBASE PROGRAMMERS

When we found FoxBASE we couldn't convert our own applications fast enough! We'll give you better support. Having a better product helps too!

TRANSPORTABLE ACROSS A WIDE RANGE OF MACHINES

FoxBase is available for a wide range of operating systems, including MS-DOS, AOS/VS, UNIX, XENIX, Molecular. FoxBASE applications are compatible across all supported operating systems and can be transferred via a simple conversion program. Develop your application on a mainframe then run it on a micro!

LOW COST

The other good news is that FoxBASE is actually less expensive than dBASE. Call for prices now.

For developers, we are providing run time modules for a fraction of the asking dBase price. Upgrade applications straight away. Your clients will love you.

CEREBRAL SOLUTIONS

Phone (02) 923 2288
Please send more information on FoxBASE

Name_____

Address_____

_____

Post all enquiries to:
FoxBASE, PO Box 741, North Sydney

dBase II is a trademark of Ashton Tate

LETTERS

The power of conviction

I was pleased that my article 'New Life' (November 1985) stimulated interest.

Dr Beardwood ('Letters', January 1986) declares we are 'in control in a literally supernatural nondeterministic way'. This is self-contradictory, since control is a deterministic concept. Moreover, I see no reason to believe that we have a 'supernatural component'.

Stephen Burt and P Lewis ('Letters', January 1986) are right to state that many plants reproduce asexually, but *some* do not, and so my case rests: some species require assistance from other species in order to reproduce. This is a nice precedent for reproduction among computer-based systems.

The two key questions are: is a systems definition of life satisfactory; and can appropriately configured computer-based systems meet the requirements of such a definition?

G Simons

Time difference

In an industry with such a strong Japanese presence as this, most people are sadly aware of the problems and misunderstandings which can arise in translation.

What is perhaps much less widely appreciated is the apparent differences between Japanese and Australian fundamental units of time.

I have done some original research in this area and have come across a most remarkable anomaly. It is this: one Japanese second is not only different from one Australian second, but *the ratio itself actually varies in what seems to be a quite arbitrary way.*

This is best illustrated by a few examples (Fig 1). Due to the possibility of variations due to geographical location, I refer to our unit of time as the Sydney second:

The experiments were carried out under controlled conditions, using self-test on the printers and automatic repeat on the typewriter; I was unable to find any other mode in which any of the machines would operate more quickly. Unfortunately, I had to use a Japanese stopwatch, but I was unable to identify any way in which it could have been favourably influenced by the experiment subject. Further tests established that its design seemed to be based, near enough, on the Sydney second, which cannot differ all that much from the Greenwich unit.

A colleague, confronted with these figures, suggests that the discrepancy is due, not to differences in the value of the second itself, but to the Japanese figure being based on theoretical rates of which the machines are capable *when not actually printing*, but this explanation is clearly too absurd to entertain.

Has any other reader done work in this field which would shed some light on a puzzling phenomenon?

G Sutherland

Example	*Speed in chars per Japanese second*	*Speed in chars per Sydney second*	*Inferred ratio, Jap: Sydney second*
Japanese electronic typewriter	12	7	1.714
Japanese daisywheel printer	20	15	1.333
Japanese dot matrix printer	160	115	1.391

Fig 1

BLUDNERS

The listing in last month's Programs section for the Commodore 64 'Program Editor' was very difficult to read in some copies of the magazine. Any readers wanting a clearer photocopy of the program should call or write to Maria Bokic in our Sydney office.

Due to a small technical hitch the following copy was left off February's article "I think therefore I am. (Page 68)

"amoeba? Surely the fact that the thing ultimately being modelled, the amoeba, is alive does not mean that anything modelling that life must also be alive? Yet it must contain all the subsystems of the amoeba or be an incomplete simulation. It should be clear that a description of a life is not a life, and a model, or a simulation, is a description."

END

FREE SOFTWARE

SPECIAL SELECTIONS FROM THE PUBLIC DOMAIN (02) 29 2866

Well, almost free. We don't charge for the public domain software but there is a small all-inclusive service charge of $15 per disk to cover promotion costs, copying, postage, etc. Disks are available for CP/M and MS-DOS and APPLE. Mail and telephone order only.

The programmes have been carefully selected, tested and documented. They'll run on a wide variety of computers that accept 5¼" disks. Most of the programmes are machine independent and will run as is. In some cases (such as modem/communication programmes) it is necessary to indicate the sort of terminal being used. Where minor changes are required to customize a programme, source code is usually provided. Testing has been carried out for CP/M disks on a Z80 Kaypro II.

About 120 different formats are supported, including Kaypro, Osborne, Tandy and Microbee, Televideo and Apple II, but not Commodore 64

(We have many more disks than we can list here. Please ring or write for our free catalogue. Purchasers of the disks below will receive it automatically.)

CP/M

DISK No.

CP1 **GAMES.** Menu-driven, compiled games, including an excellent one that prints bio-rhythm charts, a clever horse race, and a space trader programme for the wheelers and dealers.

CP2 **GAME.** A 191k version of Adventure, the classic game which can absorb your attention for days at a time. This is a 550 pt version with an expanded cave and smarter creatures.

CP3 **GAMES.** More fascinating games to absorb time you can't spare — such as a six level chess game, Othello, a well-written multi-level version of Pacman and an extensive Wumpus adventure game.

CP4 **GAMES.** Some outstanding games written in Mbasic, with source. Includes golf, a hunting game (like space invaders) called Duck where the ducks fight back, and a super adventure game where you can choose your personal strengths. Also contains a keyboard translator like Smartkey.

CP21 **UTILITIES.** A whole heap of useful programmes to catalogue your files, arrange the directory display, make emergency alterations to the disk, allow printing and computing at same time, count words, print the screen, copy better, erase, unerase, delete, make batch commands, etc.

CP23 **Z80 MACRO ASSEMBLER.** The syntax closely follows RMAC and MAC. A bargain at a fraction of their cost.

CP25 **Z80 DISASSEMBLER.** Includes DASM, an easier to use version of ZZSOURCE, and XLATE, a very good 8080 to Z80 translation routine. Source and documentation are included.

CP28 **UTILITIES.** A super collection of some of the best uitilities available, such as NEWSWEEP, NULU (file library), SUPERZAP and VDO-KP.

CP29 **EZCPR.** Whereas ZCPR is a famous replacement for CP/M with fancy tricks that will keep you from returning to CP/M, EZCPR Is a much easier to install lookalike for ZCPR that works on just about any system. Well worth having.

CP61 **MX80 PRINTER GRAPHICS.** A comprehensive graphics package for those with Epson MX-80 printers and look alikes. Includes sample files.

CP81 **LANGUAGE — FORTH.** This is the famous F83, which adopts the latest Forth standard. Has built-in editor, compiler, etc.

CP82A **LANGUAGE — SMALL C COMPILER, VERSION 2.1.** Inexpensive way of learning to use C. A published handbook is widely available.

CP83 **LANGUAGE — SMALL C LIBRARY.** Contains 105 C functions, many described in Jim Hendrix's "Small C Handbook". A lot are written in assembler and most are OK for any CP/M system.

CP101 **COMMUNICATIONS. TURBO PASCAL BULLETIN BOARD.** A complete bulletin board package that has been highly praised by users.

CP102 **COMMUNICATIONS. MDM730.** A popular and widely used system. Easily adapted to different machines. Source code and extensive documentation is included. An Apple/CPM version is also available.

CP141+ **DBASEII APPLICATIONS.** A powerful collection of 5 disks with fully developed applications packages, programme extensions, and algorithms. Includes super mail-management, inventory control, phone tracking, budgetting, graph-making facilities, patches, checking for duplicate entries, menu creation, and many more. $50 the set instead of $75.

MS/DOS

M1 **GAMES.** Includes a graphic, conversational and intelligent adventure game as well as a Star Trek-type adventure and a surprise called Bouncing Baby.

M2 **GAMES.** Fifteen Pascal games compiled with source code. There is also a musician programme so that you learn about music while you write songs and a programmer's calculator which shows the internal workings of stack, memory, and registers.

M3 **GAME. ADVENTURE.** You guessed it, the original classic written in C with source. Compiled for immediate play.

M21 **UTILITIES.** These are essential and include file maintenance superstars like SWEEP and WASH as well as library and squeeze/unsqueeze programmes. Lots of them.

M22 **UTILITIES WITH ASSEMBLER/DISASSEMBLER.** Has a ramdisk programme, print while you work spooler, wordstar converter, as well as assembler/disassembler.

M23 **UTILITIES.** Make life easier for yourself with programmes like Util, Z, Vtype, ST, Protect, Unprotect.

M24 **UTILITIES.** Ultra Utilities can unerase files, patch, optimise Basic source code, generate Basic code for custom data bases, and more.

M26 **UTILITIES FOR PERSONAL MANAGEMENT.** Similar to Sidekick, these are background utilities that provide calculator, notepad/editor, phone index, alarm clock, calendar, printer controls, typewriter simulator, window access to directory, display/remove/copy/rename files, etc.

M41 **WORD PROCESSOR.** Considered at least as good as the commercial programmes. Contains PC-Write latest version (2.55) plus extensive manuals. For editing and formatting.

M81 **LANGUAGE. FORTH.** This is F83, the latest standard, with built-in editor, compiler, etc.

M82 **LANGUAGE. SMALL C:PC VERSION 1.1.** Ron Cain's compiler for those interested in learning the C language.

M83 **LANGUAGE. XLISP VERSION 1.5.** An experimental language with object-oriented extension capability. Used in artificial intelligence programming, etc. CPM80 version also on hand.

M101 **COMMUNICATIONS. MODEMS.** Two major communication programmes—Qmodem and Kermit. Lots of bells and whistles.

M102 **COMMUNICATIONS. SINGLE-USER BULLETIN BOARD.** Source included. Set up your own message service.

M121 **GENERAL LEDGER ACCOUNTING.** A small-business recording system.

M122 **SPREADSHEET CALC.** A comprehensive programme for budgetting, projects, "what if" calcs etc. Good documentation on disk. Suit home, school, small science/engineering/accounting uses.

M123 **INVESTMENT RECORD SYSTEM.** See how your money grows and how to keep track of it. Puts order into your finances and keeps track of costs, income, profits, losses, etc.

M125 **PROJECT/TIME MANAGEMENT.** Improving organisation and goal accomplishment. Arranges information, prompts for action.

M142+ **DBASE II/III APPLICATIONS.** Extensive group of Dbase applications, programme extension and algorithms. Includes cheque programme, mail management, inventory control, budgetting and accounting, memo maker, phone index, menu drive, typewriter simulation, depreciation, automatic formatting, search for duplicate entries, Spanish lessons, runtime decoder, graphics and other utilities. Set of 5 for $50 instead of $75.

M143 **FAMILY TREE/GENEALOGY.** Extensive programme in Basic for recording, tracing, grouping, printing, etc., family relationships.

APPLE II

Ring or write for free catalogue.

PUBLIC DOMAIN NEWSLETTER

For news, reviews, views and how to use public domain software subscribe to our bi-monthly newsletter and keep informed on the free programmes that help your computer to serve you. Only $15 per annum. Includes updates to catalogue.

ORDERS:

*Each disk costs $15 including postage.
*The Public Domain Newsletter costs $15 per annum and is issued bi-monthly.

PAYMENT BY MAIL TO: Box C343 Clarence St, PO, Sydney NSW 2000.
TELEPHONE ORDERS: Pay by Bankcard, Mastercard or Visa. (02) 29 2866.
OFFICE: 3 Barrack St., Sydney. NSW.

PLEASE INDICATE THE DISK FORMAT REQUIRED WITH AN ALTERNATIVE FORMAT IF POSSIBLE.

SELECT SOFTWARE

Mail And Telephone Order Only.

We cannot guarantee the suitability of public domain/user-supported software for users' needs or equipment.

New for old?

Don't think you have to get rid of your old micro just because you're buying a new one: one might easily complement the other. Gavin Haines has some useful tips on choosing a second micro and converting your software, using a BBC Micro and an Apple II as his example.

Computer journalists often give the impression that you should throw away your present machine and buy the most recently launched micro. However, there will always be a new micro around the corner, and no matter what machine you have, sooner or later it will become obsolete.

Why not just buy a second micro and keep your old one? Your new micro could become a development of existing facilities. There's not a great demand for second-hand machines, so you'll never get your original outlay back, added to which you'll lose your software collection, and you will have to transfer all your data to the new machine. In short, if you get rid of your trusty micro, you might well live to regret it.

A second micro can be useful in a number of ways. You can transfer programs to be listed to a word processing program, and while the other machine is printing out you can continue working. New machines are often offered at enormous discount, and it can be cheaper to buy a new machine with bundled software, than to buy a separate spreadsheet, word processor and database for your existing machine.

```
100  REM  **********************
110  REM  * FOR APPLE DOS 3.3 *
120  REM  * APPLESOFT BASIC   *
130  REM  * LAST UPDATED      *
140  REM  * 08-NOV-85         *
150  REM  **********************
160  REM
1000  HOME
1010  VTAB 2
1020  PRINT "EPSON APL PRINTER DRIVER"
1030  PRINT
1040  PRINT "(Assumes card is in slot 1)"
1050  PRINT
1060  PRINT "To save as a binary file:-"
1070  PRINT "BSAVE DRIVER,A$2F0,L$BF"
1080  PRINT
1090  PRINT "After BRUNning, the printer can be"
1100  PRINT "selected from Applesoft by typing & <cr>"
1110  PRINT "(From integer BASIC CALL 1013 or 768)"
1120  PRINT "For other packages, starting address is
      $300 (hex) or 768 decimal."
1130  PRINT
1140  PRINT "POKE938,desired number of columns"
1150  PRINT "(default is 80)"
1160  PRINT "POKE939,0 to kill formatting"
1170  PRINT "POKE939,255 to restore (default)"
1180  PRINT "POKE940,255 to kill video"
1190  PRINT "POKE940,0 to restore video (default)"
1200  PRINT "POKE942,tab (default = 5)"
1210  READ A$
1220  REM
1230  IF A$ = "STOP" THEN 1340
1240  GOSUB 1270
1250  GOTO 1210
1270 A$ = A$ + " N D9C6G"
1280  FOR I = 1 TO  LEN (A$)
1290  POKE 511 + I, ASC ( MID$ (A$,I,1)) + 128
1300  NEXT
1310  POKE 72,0
1320  CALL  - 144
1330  RETURN
1340  CALL 752: END
2000  DATA  "02F0:A9 4C 8D F5 03 A9 00 8D"
2010  DATA  "02F8:F6 03 A9 03 8D F7 03 60"
2020  DATA "0300:A5 24 8D AD 03 A4 37 A9"
2030  DATA "0308:1B 85 36 A9 03 C5 37 F0"
2040  DATA "0310:09 85 37 C0 FD F0 03 4C"
2050  DATA "0318:EA 03 60 C9 80 B0 06 29"
2060  DATA "0320:3F 69 20 49 E0 48 2C C1"
2070  DATA "0328:C1 30 FB AD AD 03 C5 24"
2080  DATA "0330:68 48 B0 02 A9 A0 2C 9F"
2090  DATA "0338:03 F0 08 EE AD 03 D0 03"
2100  DATA "0340:CE AD 03 20 A0 03 68 48"
2110  DATA "0348:90 DC 49 8D D0 0A 8D AD"
2120  DATA "0350:03 85 24 A9 8A 20 25 03"
2130  DATA "0358:68 48 2C AC 03 30 05 20"
2140  DATA "0360:F0 FD A9 00 2C 9F 03 F0"
2150  DATA "0368:02 E6 24 AD AD 03 C9 FF"
2160  DATA "0370:F0 2C 38 ED AA 03 B0 17"
2170  DATA "0378:2C AB 03 10 21 E9 F7 90"
2180  DATA "0380:1D AD AA 03 CD AD 03 F0"
2190  DATA "0388:06 68 48 49 A0 D0 0F A9"
2200  DATA "0390:8D 20 25 03 2C AB 03 10"
2210  DATA "0398:05 AD AE 03 85 24 68 60"
2220  DATA "03A0:8C A9 03 29 7F 8D 90 C0"
2230  DATA "03A8:60 00 50 FF 00 00 06 41"
2240  DATA "STOP"
```

Fig 1 Basic program

Choice

What type of machine should you buy as a second micro? If you would like to be able to learn 68000 assembly language, the Atari 520ST or the QL could be irresistible at heavy discount. But from the point of view of transferring machine language programs, it is a good idea to get another machine which uses the same processor; for example, it is logical to go from an Apple II to a BBC Micro, or from a Sinclair Spectrum to an Amstrad.

Secondly, what interfaces does the machine under consideration have? If both micros have RS232 sockets, it will be relatively easy to transfer software and data. Failing this, look for a Versatile Interface Adapter (VIA) or user port. The Commodore 64, for example, does not have an RS232 socket, but it does have a VIA, so you could hook it to, say, a BBC Micro without additional hardware.

In an earlier article entitled 'Getting together' (*APC*, July 1985), I described how you could interface an Apple to a BBC Micro, using the Apple games socket and the BBC user port. This

Illustration by Chris Winn

Can't decide?

olivetti

NEC APCIII

Both these machines run industry standard software at nearly twice the speed of other compatibles, and each manufacturer provides solid back-up support throughout Australia. So if you're having trouble deciding, why not phone A.T.S. COMPUTING for unbiased advice? If you can't make it to our Sydney or Melbourne showrooms speak to Doug Cotton on (02) 858-5999 about our interstate and country services. The following are just some of the many packages we can tailor to your needs:—

NEC APCIII with dual 720K drives, 640K RAM, SLE card (for compatibility), high speed Near Letter Quality (NLQ) printer and cable, PLUS A.T.S. Practice System (the fastest running, and perhaps fastest selling Medical, Dental and Professional package) OR Enable (integrated word processing, spread sheet, database, graphics and communications) and S.B.A. software (debtors, creditors, general ledger, stock) — $4,995 incl. tax.

OLIVETTI M24 with dual 360K drives, 640K RAM and NEC P2 180 c.p.s. NLQ printer, bi-directional tractor and cable PLUS S.B.A. software (as above) — $4,995 incl. tax.

NEC APCIII 10 Megabyte system with 640K RAM, SLE card and wide carriage 180 c.p.s. NLQ printer, bi-directional tractor and cable (all covered by 12 month warranty) PLUS A.T.S. Practice System OR Enable and S.B.A. software (as above) — $6,840 incl. tax.

OLIVETTI M24 with 20 Megabyte Tandon drive, 640K RAM and NEC P3 wide carriage 180 c.p.s. NLQ printer, bi-directional tractor and cable, PLUS Enable software — $6,995 incl. tax.

All systems include keyboard and manufacturer's monochrome monitor. Add $700 for NEC colour or $800 for Olivetti colour in lieu of mono.

Phone for great discounts on top quality printers, modems, expansion cards, co-processors, disc drives, software etc. Super Special: Tandon 20 Meg drive with controller and cables $1,225 incl. tax.

SYDNEY: Phone (02) 858 5999
1039a Victoria Rd., West Ryde 2114

MELBOURNE: Phone (03) 690 9196
7th Flr, 96 Albert Rd., South Melbourne

All mail orders and other State enquiries to Sydney office.

A.T.S. COMPUTING

"Advanced Technology + Service"

```
]ASM
                        1     * APPLE TO BEEB 1.1
                        2     * BBC TO APPLE INTERFACE PROGRAM
                        3     * LAST UPDATED 26/JUL/1984
                        4
                        5     * ENTRY POINT: $6000
                        6
                        7     * BIG MAC ASSEMBLER
                        8     * ZERO PAGE LOCATIONS
                        9     WORD      =     $FA
                        10    COUNT     =     $B6
                        11    KSWL      =     $38
                        12    CH        =     $24
                        13    CSWL      =     $36
                        14    *
                        15    * APPLE RC  INES
                        16    UNHOOK    =     $FE89
                        17
                        18
                        19    MARK      =     $C059
                        20    SPACE     =     $C058
                        21    SETAN1    =     $C05A
                        22    CLRAN1    =     $C05B
                        23    SW0       =     $C061
                        24    SW1       =     $C062
                        25    COUT      =     $FDED
                        26    HOME      =     $FC58
                        27    *
                        28    RECON     =     $3EA
                        29    AMP       =     $3F5
                        30    COUT1     =     $FDF0
                        31
                        32              ORG   $6000
                        33
6000: A9 4C             34              LDA   #$4C
6002: 8D F5 03          35              STA   AMP
6005: A9 10             36              LDA   #INIT
6007: 8D F6 03          37              STA   AMP+1
600A: A9 60             38              LDA   #>INIT
600C: 8D F7 03          39              STA   AMP+2
600F: 60                40    EXIT      RTS
6010: 20 58 FC          41    INIT      JSR   HOME
6013: A9 80             42              LDA   #$80          ;MASK FOR BIT 7
6015: 8D F3 60          43              STA   FLAG
6018: 2C 61 C0          44              BIT   SW0           ;IS LINE HIGH?
601B: 10 F2             45              BPL   EXIT          ;EXIT IF IT IS.
601D: 2C 5B C0          46              BIT   CLRAN1        ;PULL LINE LOW
                        47
6020: A5 24             48              LDA   CH
6022: 8D F2 60          49              STA   COLCNT
6025: A4 37             50              LDY   CSWL+1
6027: A9 3B             51              LDA   #OUTPUT
6029: 85 36             52              STA   CSWL
602B: A9 60             53              LDA   #>OUTPUT
602D: C5 37             54              CMP   CSWL+1        ;ENTRY ALREADY MADE? IF SO,
602F: F0 09             55              BEQ   NODOS         ;DON'T ACCIDENTALLY RECONNECT
6031: 85 37             56              STA   CSWL+1
6033: C0 FD             57              CPY   #>COUT1
6035: F0 03             58              BEQ   NODOS
6037: 4C EA 03          59              JMP   RECON
603A: 60                60    NODOS     RTS
                        61
603B: C9 80             62    OUTPUT    CMP   #$80          ;NORMAL CHR?
603D: B0 06             63              BGE   OUTPUT1       ;BRANCH IF SO
603F: 29 3F             64              AND   #$3F          ;CONVERT FLASH AND INVERSE
6041: 69 20             65              ADC   #$20          ;TO NORMAL (CARRY IS CLEAR).
6043: 49 E0             66              EOR   #%11100000
6045: 48                67    OUTPUT1   PHA
6046: AD F2 60          68    OUTPUT2   LDA   COLCNT        ;IF COLUMN COUNT IS LESS
6049: C5 24             69              CMP   CH            ;THAN HORIZONTAL CURSOR
604B: 68                70              PLA                 ;THEN SEND A SPACE.
604C: 48                71              PHA
604D: B0 02             72              BCS   TESTCTRL
604F: A9 A0             73              LDA   #" "
6051: 2C B6 60          74    TESTCTRL  BIT   RTS1          ;TEST FOR CONTROL CHR
6054: F0 08             75              BEQ   PRNTIT
6056: EE F2 60          76              INC   COLCNT
6059: D0 03             77              BNE   PRNTIT
605B: CE F2 60          78              DEC   COLCNT        ;DON'T "INC" TO 0
605E: 20 B7 60          79    PRNTIT    JSR   DOCHAR
6061: 68                80              PLA
6062: 48                81              PHA
6063: 90 E1             82              BCC   OUTPUT2       ;CAUGHT UP WITH CH?
6065: 49 8D             83              EOR   #$8D          ;TEST FOR CR
6067: D0 0F             84              BNE   FINISH        ;NOT CR, WIND UP
6069: 8D F2 60          85              STA   COLCNT        ;YES CR, ZERO COL COUNT
606C: 85 24             86              STA   CH            ;IN CASE OF NOVID MODE
606E: 2C F4 60          87              BIT   LINFEED
6071: 10 05             88              BPL   FINISH
6073: A9 8A             89              LDA   #$8A          ;SEND LINEFEED
6075: 20 45 60          90              JSR   OUTPUT1
6078: 68                91    FINISH    PLA
6079: 48                92              PHA
```

Fig 2 Assembly listing.

method uses no hardware apart from a connecting lead, and it also has the advantage of leaving the BBC Micro's RS232 socket free for connection of other equipment. However, you *do* need to write a machine language driver routine at each end.

If you cannot justify expenditure on what is really 'just a hobby', constructing the interface and writing the software is an instructive exercise. But if your application is very serious, you would be better off just buying the required hardware and software.

The third consideration in choosing a second micro is: does the price include disk drives? By interfacing the two machines, you can avoid having to buy additional disk drives. The QL, for instance, has RS232 ports, so if you found microdrives disconcerting, you could save files to disks on your old micro. With some micros, such as the Commodore 64, the disk system is even slower than turbo tape. Rather than get the notoriously slow Commodore 1541 drive, you could save programs to disks on a second micro through the 64's user port.

'What type of machine should you buy as a second micro? If you would like to be able to learn 68000 assembly language, the Atari 520ST or the QL could be irresistible . . .'

Connection

So, you have two computers and you would like to be able to transfer programs and data. How do you approach the problem?

In our case part of the solution to the problem lay in the history of th Apple. In the early days before the advent of peripheral cards, Steve Wozniak, one of the designers of the Apple II, needed *hard copy*, so he wrote a machine language program to drive a teletype via the games socket. The circuit uses a pair of resistors and transistors to implement an RS232 output.

With modifications, the teletype routine can be used to drive any device via any of the Apple output locations. Some parallel interface cards, like early versions of the Epson APL board, have firmware which cause packages such as VisiCalc to crash. You can avoid this problem by substituting your own printer driver (Fig 1 gives an example in

the form of a Basic program; if you want to understand the machine code, disassemble and compare it to Fig 2). The Basic program also demonstrates a general technique for entering hex data into the Apple without using the monitor.

Fig 2 gives an assembly listing of the version of the routine used to transmit data to the BBC Micro. (You can, of course, assemble it to any address, if you write more code than will fit; $6000 hex was used in this case.) It can serve as a tutorial on how to write such a driver for different applications on any 6502-based machine.

Once your two machines are connected together, and the interface is up and working, things start to get interesting. But be aware of the extent to which the different makes of machine are not compatible. Newcomers to the micro world often expect software from one machine to work on another — and are often sadly disappointed. Those who wrote in response to the earlier article expected to be able to run BBC Basic programs on the Apple, or hoped to connect Apple drives with the BBC Micro.

'But from the point of view of transferring machine language problems, it is a good idea to get another machine which uses the same processor; for example, go from an Apple II to a BBC.'

Software conversion

So, before you begin work on converting software, think carefully. Is it worth it? If you have both machines, you can make it *appear* that the BBC Micro is running Apple software or that the Atari contains a Commodore 64! When you attach a second processor to, say, the BBC Micro, you have in effect a small host computer. The BBC Micro acts as a terminal to this host computer. Although the second processor is located outside the BBC Micro, it *appears* to be part of it. Once you have grasped this, it is easy to see that the host computer could be any make of machine.

The BBC Micro has code-driven graphics, so you can change the screen mode, draw triangles, and so on, by sending a series of control characters to the output channel (OSWRCH). In our

```
607A: 2C F1 60  93            BIT  VIDEO       ;VIDEO REQUESTED?
607D: 30 05     94            BMI  NOVID       ;BRANCH IF NOT
607F: 20 F0 FD  95            JSR  COUT1       ;SEND TO SCREEN
6082: A9 00     96            LDA  #0          ;TO FORCE FALL THROUGH TO
                                                 CHKBND
6084: 2C B6 60  97  NOVID     BIT  RTS1        ;CONTROL CHR?
6087: F0 02     98            BEQ  CHKBND      ;DON'T INC CH IF CONTROL CHR
6089: E6 24     99            INC  CH          ;UPDATE CH IF NOVID
608B: AD F2 60  100 CHKBND    LDA  COLCNT      ;CHECK WINDOW
608E: C9 FF     101           CMP  #$FF        ;255 WIDTH?
6090: F0 23     102           BEQ  RETURN      ;IF SO, DON'T TEST WNDWDTH
6092: 38        103           SEC
6093: ED EF 60  104           SBC  WNDWDTH
6096: B0 0F     105           BCS  CR          ;DD A CR IF AT RIGHT MARGIN
6098: 2C F0 60  106           BIT  LISTFLG     ;PROXIMITY CHECK REQUESTED?
609B: 10 18     107           BPL  RETURN      ;BRANCH IF NOT
609D: E9 F7     108           SBC  #$F7        ;ARE WE WITHIN 7 CHRS OF END?
609F: 90 14     109           BCC  RETURN      ;BRANCH IF NOT
60A1: 68        110           PLA              ;GET LAST CHR
60A2: 48        111           PHA
60A3: 49 A0     112           EOR  #'          ' ;WAS IT A SPACE?
60A5: D0 0E     113           BNE  RETURN      ;BRANCH IF NOT
60A7: A9 8D     114 CR        LDA  #$8D        YES, DO CR
60A9: 20 45 60  115           JSR  OUTPUT1
60AC: 2C F0 60  116           BIT  LISTFLG     ;"BASIC" LISTING OPTION?
60AF: 10 04     117           BPL  RETURN      ;BRANCH IF NOT
60B1: A9 06     118           LDA  #6          ;YES, TAB IN 6 SPACES
60B3: 85 24     119           STA  CH
60B5: 68        120 RETURN    PLA
60B6: 60        121 RTS1      RTS
                122
                123
60B7: 8C EE 60  124 DOCHAR    STY  YSAVE
60BA: 08        125           PHP              ;SAVE REGS
60BB: 29 7F     126           AND  #%01111111
60BD: 85 FA     127           STA  WORD
60BF: A0 08     128           LDY  #8
60C1: AD 61 C0  129 HSHAKE    LDA  SW0         ;READ HANDSHAKE LINE
60C4: 4D F3 60  130           EOR  FLAG        ;CHANGED STATE?
60C7: 10 F8     131           BPL  HSHAKE      ;NO, BRANCH
60C9: AD 61 C0  132           LDA  SW0         ;SAVE STATUS OF HANDSHAKE
                                                 LINE
60CC: 8D F3 60  133           STA  FLAG
60CF: 0A        134           ASL  A           ;SHIFT BIT INTO CARRY

60D0: 90 05     135           BCC  AN1ON       ;SEND A ONE IF CARRY CLEAR

60D2: 2C 5B C0  136           BIT  CLRAN1      ;SEND A ZERO IF NOT
60D5: B0 03     137           BCS  WRBIT       ;AVOID RESETTING AN1 BY DEFAUL
60D7: 2C 5A C0  138 AN1ON     BIT  SETAN1
60DA: 26 FA     139 WRBIT     ROL  WORD
60DC: B0 05     140           BCS  SEND1
60DE: 2C 58 C0  141           BIT  SPACE
60E1: 90 03     142           BCC  NEXT
60E3: 2C 59 C0  143 SEND1     BIT  MARK
60E6: 88        144 NEXT      DEY              ;ANY MORE
60E7: D0 D8     145           BNE  HSHAKE
60E9: AC EE 60  146           LDY  YSAVE
60EC: 28        147           PLP              ;RESTORE REGS
60ED: 60        148           RTS
                149
                150 YSAVE     DS   1           ;SCRATCH
                151
                152 * WNDWDTH: POKE WNDWDTH,DESIRED WIDTH
                153 *    [DEFAULT = 80 COLUMNS]
                154 *    POKE 970,255 WILL DEFEAT
                155 *    MARGIN CHECK AND CAN BE USED
60EF: FF        156 WNDWDTH   DFB  $FF
                157
                158 * THE FOLLOWING 3 FLAGS ARE
                159 * TESTED ONLY FOR SIGN:
                160
                161 * LISTFLG: POKE LISTFLAG,255 FOR A
                162 *    BASIC-LIKE LISTING.  FOR
                163 *    LISTING A BASIC PROGRAM, ALSO
                164 *    POKE 33,33 AND SELECT VIDEO.
                165 *     [DEFAULT = NOT DONE]
                166
                167 * VIDEO: POKE VIDEO,255 TO DEFEAT
                168 *    PRINTING TO THE SCREEN.
                169 *     [DEFAULT = VIDEO ON]
60F0: 00        170 LISTFLG   DFB  $00
60F1: 00        171 VIDEO     DFB  0
                172 COLCNT    DS   1
                173 FLAG      DS   1
60F4: FF        174 LINFEED   DFB  $FF

--End assembly--

245 bytes

Errors: 0
```

Fig 2 continued

BATTERIES INCLUDED

"The Energized Software Company!"

ECP announces the complete range of Batteries Included software

A Billboard magazine No. 1.

Paperclip for the Commodore

A powerful but simple to use wordprocessing program. Its advanced features are hard to match even in much more expensive systems and comes with or without spellpack.

Available for the C64/128, Atari and Paperclip with spellpack available on C128

The new Consultant for the Commodore

Perform a variety of sophisticated search and analysis procedures. Ideal for both home and business.

Available for the C64/128 IBM

B/Graph

Charts. Graphs. Statistical Analysis. Easily done, and the results are spectacular. Your data never looked so good!

Available for Atari & Apple

Buscard II

Connect almost any printer and Commodore compatible disk drive to your C-64 — and transform it into a high-performance business system!

Available for C64/128

B.I. Printer Interface

Connect almost any Centronics-type parallel printer to your Commodore computer. The easy way!

Available for C64/128

B.I.-80 Column Display

Double your screen capacity — and increase the clarity of your display — with this plug-in adaptor.

Available for C64/128

Calkit

Solves difficult home and business number problems for you, in a fraction of the time

Available for C64/128

As reviewed in December APC.

Homepak

Word processing. Information management. Telecommunications. The three most useful home computer applications, on one diskette!

Available for C64/128 Atari and Apple

Keys to Typing

Learn to type 40 words a minute in 32 easy lessons — or less!

Available for C64/128

Now available from:

Entertaining Australasia.

ECP ENTERTAINMENT & COMPUTER PRODUCTS PTY LTD

3A/3-9 Kenneth Rd., Manly Vale 2093.
Australia. Phone (02) 949 7300.
Telex No 176039 ENTCOM

Please contact your local ECP representative:

Vic ECP Pty Ltd, 1981 Malvern Rd, Malvern East. Ph: (03) 211 8410
Qld Computronic, 8 Harlequin St, Sunnybank Hills, Qld, 4109. Ph: (07) 273 3398.
S.A. Phil Stubbs Agency, 239 McGill Rd, Maylands, S.A., 5069. Ph: (08) 332 9827.
W.A. John Mills Agency, PO Box 278, Greenwood, W.A., 6024. Ph: (09) 448 1137.
Tas. Tasmanian Record Company, 10 Cameron St, Launceston, Tasmania, 7250. Ph: (003) 31 5588.

Figure 2 continued

```
Symbol table - alphabetical order:

   AMP      =$03F5      AN1ON    =$60D7      CH       =$24        CHKBND   =$608B
   CLRAN1   =$C05B      COLCNT   =$60F2   ?  COUNT    =$FB     ?  COUT     =$FDED
   COUT1    =$FDF0      CR       =$60A7      CSWL     =$36        DOCHAR   =$60B7
   EXIT     =$600F      FINISH   =$6078      FLAG     =$60F3      HOME     =$FC58
   HSHAKE   =$60C1      INIT     =$6010   ?  KSWL     =$38        LINFEED  =$60F4
   LISTFLG  =$60F0      MARK     =$C059      NEXT     =$60E6      NODOS    =$603A
   NOVID    =$6084      OUTPUT   =$603B      OUTPUT1  =$6045      OUTPUT2  =$6046
```

case, the Apple is the host computer, so, for example, you could write a Pascal program to plot high-resolution shapes using BBC graphics. The idea is that you send the output from one machine to the other — you do not transfer a Basic program to another machine and try to execute it there. It is possible to convert programs between machines, but this is sometimes more trouble than it's worth.

But if you would like to try (in this case) converting Applesoft programs to BBC Basic you would proceed as follows:

```
LOAD PROGRAM
POKE33,33:REM kills screen
  formatting
PR#1 (if using a card which is in
  this slot)
CALL768 (if you are using your
  own routine)
LIST
.... (program listing) ....
PRINT CHR$(23)
```

On the BBC end of it you would have a simple Basic program such as:

```
10 EOF$ = CHR$(23):REM CTRL-W
20 *SPOOL "FILE"
30 A$ = GET$:IF A$ = CHR$(13)
   THEN PRINT
40 IF A$> = CHR$(32) THEN
   PRINT A$;
50 IF A$<>EOF$ THEN 30
60 *SPOOL
```

Note how line 40 prevents control codes from, say, changing MODE on the BBC Micro. Control-W is used to signal end of transmission — you can change this to something else if you like.

Having got your programs across, you can edit it using a word processor. You use the search and replace function to change instances of HOME to CLS, and so on, but it is necessary to remove surplus spaces. IF... THEN statements require particular attention. BBC Basic uses −1 to represent true and zero to represent false. But with the Apple, true is represented by +1. Many lines in the program will not work unless you amend the code. Note especially that constructions used on the Apple such as IF NOT X THEN... will not work in the same way on the BBC.

Example

For the purposes of this article, we are using the Apple and the BBC Micro as the example, but we could as easily be talking about any two different machines.

Micro development has tended to follow a pattern: a machine is introduced with a relatively small amount of memory, with subsequent versions having larger amounts. The manufacturer then switches to a new product line based on a more powerful processor. Apple Computer was launched in January 1977. The early machines had 8k of RAM which gradually became 12k, 16k, 24k, 32k until everybody had 48k. In January 1983, a re-engineered version of the machine called the Apple IIe was introduced with a 64k on the main board. Similarly, the BBC Micro was introduced with a 16k Model A, and a 32k Model B. This was followed by the BBC Plus with 64k and recently a 128k version was introduced. The Apple IIe uses the paged RAM concept like the BBC Micro. If you have an Apple II+, you can upgrade it so that most IIe facilities are available, but like the owners of the 32k BBC Micro, you can't run new software that utilises the extra paged RAM.

This pattern of development in hardware produced a parallel development in software. Programs for early micros had to be memory-efficient: the algorithm has to closely express what is actually happening inside the machine on a system with a small amount of RAM. But as you go to larger and larger systems, you can write programs without needing to know *exactly* how they are executed.

In other words, if a program were written very early on in the history of a micro, it might be difficult to convert for another machine. Much early software was written by programmers who had been closely connected with the manufacturer. These programmers were able to utilise undocumented features of the machine, of which you may not be aware from looking at a listing. Software that was written later on may be copy-protected: you may not be able to transfer programs without cracking the protection scheme.

There are a number of versions of the Apple II, as there are versions of the BBC Micro. Early Apples were shipped with Integer Basic in ROM on the main board. This is a type of Basic where you cannot use decimal points, and the advantage is speed of execution for video games. Apple Computer Inc considers Integer Basic to be obsolete, but you may find that you have software which uses it, so be sure not to confuse this with the Apple floating point Basic known as Applesoft. In Integer Basic, statements following IF... THEN on the same line are executed, whereas in Applesoft and BBC Basic they are not.

A number of Apple II compatible computers have been produced, the only official one being the ITT 2020 which was supplied with PALsoft, the ITT version of Applesoft. The ITT master disk used a relocated version of Integer Basic which runs in RAM. This can consist of a series of POKEs in an Applesoft program.

On the BBC Micro, you can define more than one workspace by changing the setting of PAGE. For example, you could put:

```
PAGE=&E00
LOAD"PROG1"
PAGE=&1900
LOAD"PROG2"
...
```

You can also do this on the Apple, using PEEKs and POKEs. On the BBC Micro, you can assemble a machine language program as part of a Basic program using the in line assembler:

```
10 FOR I=0 TO 3 STEP 2
20 P%=&C00
30 [OPTI
40 LDA#&41
50 JSR &FFEE
60 RTS
70 ] NEXT
80 CALL&C00
```

You can allocate memory for the machine language section either statically or dynamically (that is, fixed or moving depending on where the rest of the program is). However, you can also do this on the Apple (and the Commodore 64) in a roundabout way. You would assemble the machine code separately, and then use PEEKs and POKEs to move the pointers to your Basic program, creating a kind of sandwich. If you LIST an Integer Basic program which contains this embedded machine code, you will get gibberish on the screen. With an Applesoft program, the machine code section is invisible, thus forming a trap for would-be convertors.

END

Sakata DOT MATRIX PRINTERS

Your Personal Computer Deserves the Unequalled Printer Quality of Sakata.

model SP-1200 plus

120 Characters/Sec.
Near Letter Quality.
80 characters wide.
Condensed mode is ideal for tables.
9 Graphics modes
incl QUAD density.
CLEAN SUPER / SUBSCRIPT.
Also IBM graphics
compatible.
FULL 12 MONTH
WARRANTY.
with friction &
push tractor feed.

$526 incl. Sales Tax

model SP-1500

FAST 180 Chars/Sec.
Near Letter Quality.
80 characters wide.
Condensed mode, 136 Chars across.
9 Graphics modes
incl QUAD density.
CLEAR SUPER / SUBSCRIPT.
3K input buffer
Bi-directional printing.
FULL 12 MONTH
WARRANTY.
with friction &
tractor feed.

$658 incl. Sales Tax

model SP-5500

Professional wide carriage.
Near Letter Quality.
180 Characters/Sec.
136 Characters wide.
Condensed gives 233 chars across.
9 Graphics modes
incl QUAD density.
CRISP SUPER / SUBSCRIPT.
3K input buffer.
IBM graphics option.
FULL 12 MONTH
WARRANTY.
with friction &
tractor feed.

$910 incl. Sales Tax

Sakata **SP-5500**

Not all Japanese made printers are the same. The SAKATA range of dot matrix printers are the result of the latest technology, making them fast, quiet and above all – RELIABLE.

Both variable tractor and friction feed are standard. Character formats are of a high resolution. Draught mode features a 9 x 9 dot matrix, Near Letter Quality is made up by a 18 x 20 dot matrix and BIT IMAGE graphics can be as high as 8 x 1920 dots.

Fronts include: PICA, ELITE, DOUBLE WIDTH, Near Letter Quality, as well as DOUBLE STRIKE, proportional and super/sub script. These can be selected and mixed as required.

SAKATA printers have a parallel interface with buffer, while an optional serial interface provides up to 8KB RAM buffer.

SOLE AUSTRALIAN AGENTS

EMONA COMPUTERS
PTY LTD

1st FLOOR, 720 GEORGE ST, SYDNEY, PH: (02) 212 4599 TLX AA74500

The computer strikes back

In the light of the recent arms talks between Reagan and Gorbachev, Mike Scialom argues that Star Wars is a crucial issue for the computer industry.

The Star Wars proposal has shown that the West is in a state of advanced schizophrenia over its own moral, scientific and political future.

Never before has the prospect of an almost infinite budget for research and development resulted in so many scientists simply saying 'No'. A 'No' to participation in research, a 'No' to the politics behind the concept and a 'No' to ever being able to achieve the desired result. Despite that, Star Wars has stimulated little public debate within the scientific or computing fraternities. In fact, other than a great deal of petty sniping among those directly involved in the project, the silence is deafening.

Importance

This is quite shocking, considering Star Wars is by far the single most important project to be announced since the Space Race began in the mid-Fifties.

At that time there was a great deal of public and scientific hue and cry over whether man would land on the moon this century — as well as other spin-offs the programme would bring. Thirty years later, and Star Wars is met with almost total scepticism from the scientific community, and apathy and lack of interest elsewhere. It is almost as if people hope the idea will go away if it is ignored.

It won't. President Reagan is committed to the idea and has already pushed the first stages through Congress. Since America's huge budget deficit means it cannot afford Star Wars and nuclear weapons, the President has already suggested that the nuclear stockpile be cut. The fact that a major shift in policy has taken place in the US, and the rest of the so-called Western world has — or will — follow.

From here on in, the West's vast capital for military uses will be spent on computer rather than nuclear technology.

Lack of vision

There has, of course, been serious doubt as to the safety of nuclear weaponry for some time, but throughout the arms race for the last forty years, the voices of dissident US scientists could be counted on the fingers of one hand. Suddenly when Star Wars comes along with billions to back it, all these vocal scientists pop up saying it's impossible. Since when did a scientist say anything was impossible? It may be a thousand years away, it may be a pipedream which has a one in a million chance of ever becoming a reality, but impossible?

I suggest there are a number of reasons to back my theory that Star Wars is showing the West to be bankrupt — of morality and true vision.

(1) People are tired of Russia being the bug-bear. The fact is that Russia has its own separate culture and human beings to protect, just like the West.

(2) The West is running out of money. Every-increasing amount of taxpayers' money is being spent on weapons which are never used and prevent the creation of wealth in more worthwhile areas.

(3) Star Wars is totally defensive. At the end of these billions of dollars spent on Star Wars, the great American public will apparently have nothing to see for its money. Star Wars won't make big bangs, nor will the public ever know if it really works or not — until it's too late.

(4) Star Wars is embarrassing. It shows that American re-elected a President not a little out of touch with the real world, whose tardy effort to erect something worthwhile to leave behind him has split America — between those who see it for what it is and those who want to ***believe*** in something. Perhaps that is why the

scientific fraternity has yet to take it seriously.

Implications

Despite all these truths, Star Wars is happening, and a number of positive things will emerge from it:

Firstly, money that would otherwise have been spent on increasing nuclear stockpiles will go towards computer research.

Secondly, the amount of money that will be spent on the project means that *something* will come out of it. It may not be a 100 per cent effective missile defence system covering all 52 States, but such research is certain to take the computer market forwards at about five times the rate at which it is currently proceeding. The spin-offs will be felt through all sections of the market — from mainframes to the PC world to the home computer world. It will undoubtedly change the way we perceive hardware and software, which will become more integrated between themselves and the environment.

Thirdly, Star Wars will be the definitive military strategy until well into the 21st century. Military people the world over are reputedly thoroughly resistant to change; they know that as soon as you get more complicated than foot soldiers you start to put yourself at the mercy of the politicians. The need for foot soldiers in today's world is rare, and thus the military must find a role. The nuclear arms race has given it one, because everyone understands nuclear bombs in terms of very large amounts of TNT — however redundant that may be. But the computer age sees the role of military man reduced to a minimum — hence they are anxious to play down Star Wars as a pipedream.

Fourthly, Star Wars will make the whole world of communications infinitely more important than it is now. It is fair to say that despite being flavour of the month with Local Area Networks, Token Ring systems and databases-via-modem for all, computer communications have been slow to take off. The number of people using networked mainframes and PCs is far fewer at the present time than had been forecast. The main reason for this is that there are horrendous complications when it comes to installing and running such

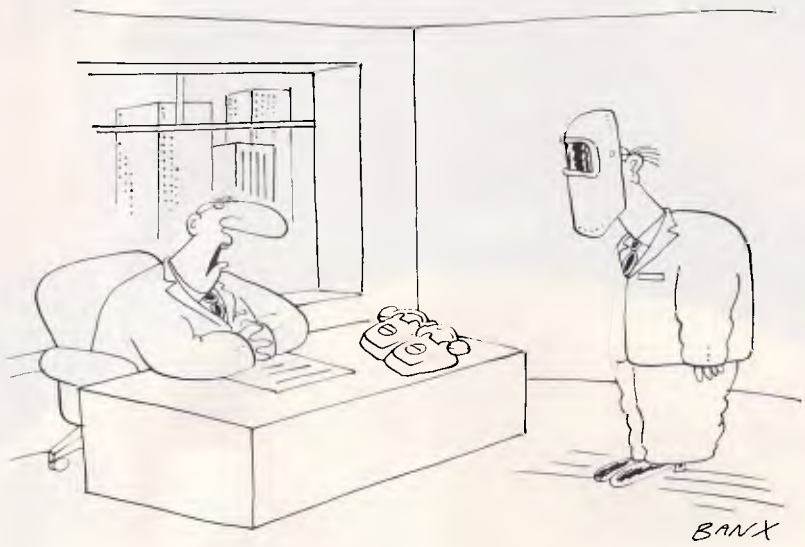
systems — many of which are incompatible with each other, highly expensive, and remain slower than an efficient paper-based system. Since Star Wars involves sophisticated tracking and communications systems which must be 100 per cent accurate over a few seconds at most, it is fair to assume that research spin-offs will allow the extended use of linked computers in the office and the home.

Finally, Star Wars more than any other scientific problem, requires a scientist of real stature and merit — perhaps genius — to come forward. The problems of intercepting missiles look extremely difficult, and the issue will show us whether our educational system will throw up someone capable of responding to the challenge.

Chance in a million

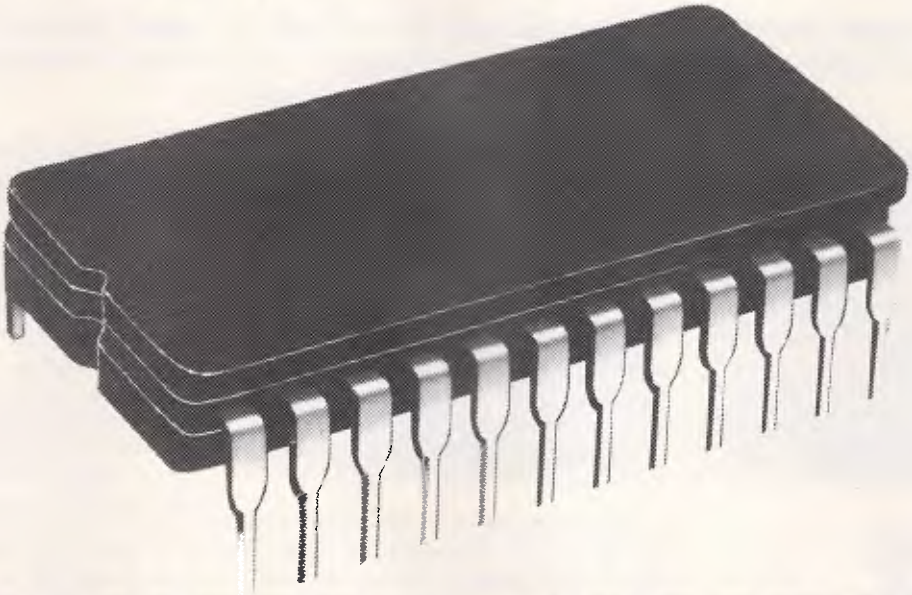
Star Wars is a chance in a million created unwittingly by a President who doesn't appear to realise that he could have started a profound revolution in the way we think about war and our neighbours behind the Iron Curtain. It would be criminal folly if the scientific — and especially the computing — establishment sat back and simply said: 'It can't be done.' But for all the interest the whole issue has generated so far, you might think that the computing world had transferred its mental faculties into silicon.

END



'Are you trying to hint that you want an anti-glare filter, Simkins?'

WHEN THE CHIPS ARE DOWN



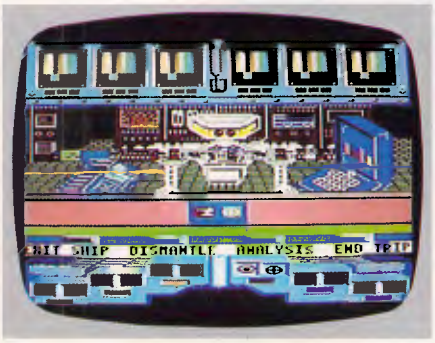
ONE NAME COMES UP

HI TECHNOLOGY HAND IN HAND WITH RELIABILITY

EXPERT MAINTENANCE, SERVICE & REPAIRS OF PERSONAL COMPUTERS & PERIPHERALS

KCM COMPUTERS PTY. LTD.
MASTER HARDWARE & SOFTWARE ENGINEERS
380 Victoria St., Richmond, 3121
Telephone: (03) 429 2733 AA39766 KCM

APC's intrepid gamester, Stephen Applebaum takes a peek inside his micro, tackles the much awaited Mercenary and more — all in this month's selection of games for the Commodore 64.



Rich pickings

GAME: Koronis Rift
MACHINE: Commodore 64/128
SUPPLIER: Imagineering
PRICE: $21.95(c)

If the Little Computer People Project was something of a disaster in entertainment terms, Lucasfilm's Koronis Rift, a superior sequel to its Rescue On Fractalus, redresses the balance, putting back the shine on Activision's tarnished escutcheon.

In this little gem, the player's *dramatis personae* is one of an intergalactic rag-and-bone man who spends his time flitting between planets in search of equipment to boost his ailing business.

Word has come through that there are valuable pickings in the ancient Koronis Rift for anyone who fancies his chances against the Guardians. Throwing caution to the solar wind, you set out for the rift and whatever dangers await you there.

Playing Koronis Rift entails flicking between two screens depicting the interior of your ship and the rift itself. Both are interesting in their own way, although the former will excite animation freaks the most.

Inside your ship is a robot that analyses equipment picked up from the rift. Above its head is a row of six monitors, four of which are operational at the start of the mission. In the foreground is a conveyor belt and a row of boxes in which to store additional pieces of hardware. At this point in the game, your only option is to glide down to the rift in search of abandoned machines.

Navigating through Koronis Rift is similar — nay, almost identical to moving over the planet's surface of its forbear, Fractalus. Once again, Lucasfilm has implemented its famous Fractalus to create a randomly changing landscape of mountains, valleys and plains. The lurching of your craft as it heaves its way up ever-increasing gradients is extremely realistic, as is the sound of its wheezing motors.

Locating wrecks is simplified by a compass which gives the heading of any craft in the immediate vicinity. As you near a craft, a message appears at the bottom of the screen warning of the presence of Guardian ships. Not until these have been dealt with can the treasure trove be looted.

Once back in the mothership you can hand your booty over to the robot for analysis: placing the relevant piece of kit on the conveyor belt galvanises the metal merchant into action. After a few quick computations on a micro at its side, the robot responds to your command with the value of the article. If it is worth a lot, and has a high efficiency value, you can install it. However, cheap pieces of equipment can be disassembled for cash. In this way you increase the potential of your ship, so making your mission that much easier.

On the whole, Koronis Rift is yet another winner from the Lucasfilm stable. The animated robot is particularly good, as is the fractal landscape, which has been improved considerably since Rescue On Fractalus.

The little people

GAME: Little Computer People Project
MACHINE: Commodore 64/128, Apple
SUPPLIER: Imagineering
PRICE: 19.95(c), $34.95(d) Apple $39.93

There's nowt as queer as folk and none queerer than Little Computer People (LCP), a hitherto undiscovered species of homonoid that lurks deep within the darkest recesses of our micros. Until recently these coy creatures had hidden from prying eyes, only making their presence known in the form of the odd program bug or glitch. To lure them into the open, Activision's David Crane constructed (in software) a 2.5-storey house containing all the little luxuries that we humans are 'expected' to own — a television, a hi-fi, a fully-equipped bathroom, and so on.

Crane's house has become the accepted method for enticing LCP from their solitude, and has been so successful that Activision has marketed the edifice, thus enabling all Commodore users to capture a pet for themselves.

If all this sounds gratuitously puerile, then you won't be surprised to learn that the program itself is flagrantly juvenile. Admittedly Crane's programming cannot be faulted (it's excellent), but good technique is no guarantee that the game is good to play.

Although I say 'play', the term is rather a misnomer in this case, as there is virtually nothing for you to do except watch your little computer person wander around the house. Initially this is quite fun, as your animated character has plenty of things to do to occupy himself, such as playing the piano, exercising, dancing, playing with his computer, watching TV, carrying out his ablutions and performing other mundane tasks that are required round the house.

Unfortunately LCP do not speak English, but make a sound which can only be likened to two hippos wallowing in a blancmange jacuzzi. Thanks to the written word, however, LCP can be contacted through the Commodore keyboard, and can even type messages to the owner via a typewriter provided in one of the upstairs rooms. These conversations are important, because apart from the look and colour on a little computer person's face, it is the only way of checking on his health.

To ease their monotonous existence, LCP have been provided with three games — poker, anagrams and a card war — all of which they can play with you. Quite often a game will be initiated by your little computer person; if this is the case you should accept the challenge, as these creatures are easily peeved and quick to sulk.

Apart from vivid graphics, imaginative sound and the odd touch of humour, Little Computer People is a disappointment which doesn't aspire to the heights which Crane so obviously had his sights set on. Even the sadistic pleasure derived from starving your little computer person into a state of confusion quickly wanes, and you are left with a program that you're unlikely to return to.

Late, but worth it

GAME: Mercenary: Escape From Targ
MACHINE: Commodore 64/128
SUPPLIER: Computermate
PRICE: $29.95(c), $39.95(d)

Mercenary opens with you crash-landing on the surface of a planet called Targ. Miraculously you survive unhurt, although your spacecraft is not so lucky. Even more fantastic than your death-defying fall is the fact that you've managed to save Benson. Benson is a ninth-generation PC, not a stereotype from a trite American sitcom (phew!). With this help, you soon track down a small flying craft and head out on an odyssey across Targ; a journey which will hopefully end in your escape from the planet.

While you're soaring through the ether, two alien factions are happily waging war with each other. The Mechanoids, who inhabit Targ, have usurped the Palyars who now orbit the planet in a secure Colony Craft. Small pockets of resistance still exist on the surface, but are few in number.

Far from being a disaster, it is possible to turn the situation into a nice little earner. For example, by running missions for one, or, if you're feeling lucky, both sides, it is possible to earn good money and gain pieces of useful equipment. However, should either the Mechanoids or the Palyars become wise to your double-dealing, you're stripped of all your belongings and left to wander the planet on foot.

When all is said and done, Mercenary's greatest attribute is its graphics, which are similar to those in Elite, although I think Elite/Aviator would be more accurate. Most impressive is the way in which the player can zoom over the planet, gradually uncovering the landmarks that lay scattered about its surface. There are bridges and buildings, and even a small advert specially erected by the programmer. Destroy that and you find yourself under attack from both the Palyars and the Mechanoids.

The wire frame graphics employed in Mercenary are limited in the amount of realism they can portray: when did an aircraft last fly through a house without flattening it?

Oddly enough, a well aimed missile can destroy an object with devastating effect. If the player accepts these quirks, Mercenary's graphics take on a new dimension, where their very abstractness heightens the alien feel of Targ.

Mercenary is a marvellous game.

END

Matrix multiplier

Lindsay Doyle describes how to generate and transform simple wire figures on your micro using matrix arithmetic.

This article should be useful to those of you who have the facility to draw lines on the screen of your micro and who would like to become familiar with the techniques for generating and transforming simple 'wire figures'. It will show how matrix arithmetic can be used to rotate, change the size of, and move an image defined by a series of points and how this process can be simplified.

As we are not yet able to actually draw in three dimensions, we must somehow represent three-dimensional figures as projections onto a two-dimensional plane. Simple figures can be represented in *orthogonal projection*, a technique often used in mechanical drawings, in which all lines that are parallel lines on the object are represented by parallel lines on the image plane. Where the effect of depth is to be shown with realism, *perspective projection* is required, in which parallel lines not in a plane parallel to the image plane are represented by non-parallel lines, whose extensions meet at 'vanishing points' on the horizon. The difference between the two is shown in Fig. 1. As perspective projection involves a number of added concepts and complexities, it will not be covered here, although the techniques described can easily be extended to do so.

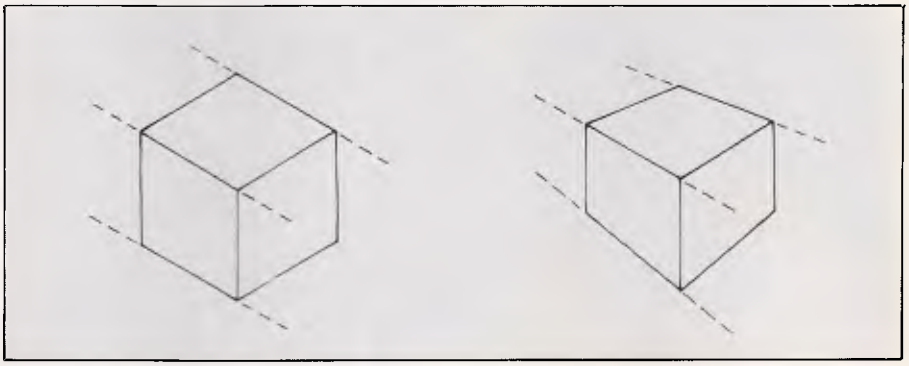


Fig 1 Orthogonal and perspective representation of a cube

Every point in three-dimensional space can be defined by three measurements in the *Cartesian coordinate system*, in which three planes at right angles to each other intersect in a point defined as the origin. Relating Cartesian space to our flat screen, we may define the origin to be at the lower left of the screen and measure positive x coordinates to the right, positive y coordinates upwards, and positive z coordinates outwards towards the viewer.

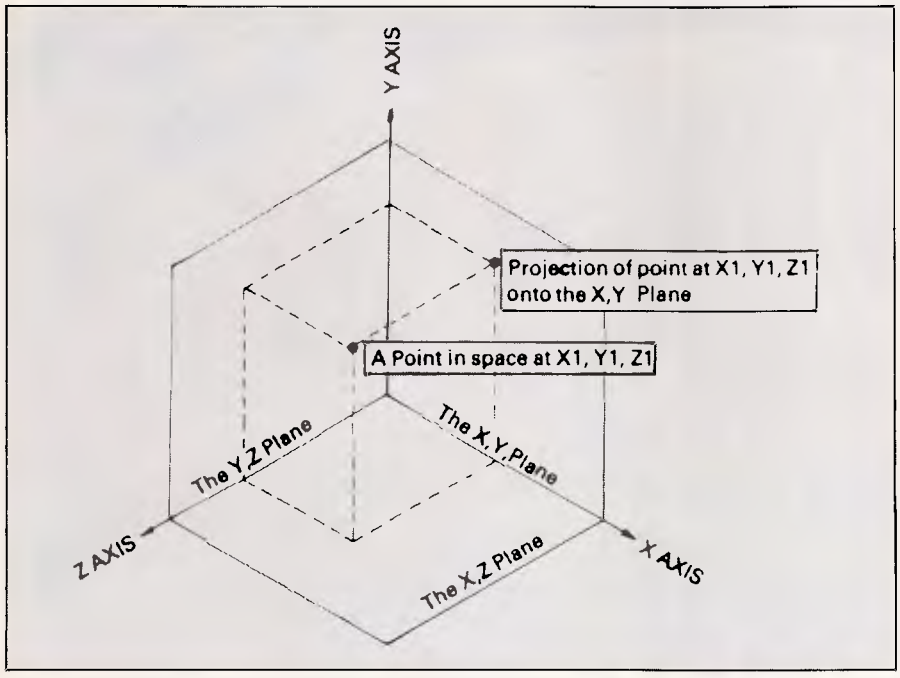


Fig 2 Cartesian coordinates referred to the screen

We speak of the x,y plane (also called the z = 0 plane) as the plane of the screen; the y,z plane as a vertical plane extending outwards from the left side of the screen; and the x,z plane as a horizontal plane extending outwards from the bottom of the screen, as labelled in Fig 2. Nothing prevents a point from having negative coordinates, but we limit this discussion to positive coordinates for simplicity. Therefore, an imaginary object in our scheme is dimensioned as if it were floating in front of the computer screen. Each point on the screen image is going to be generated by projecting a line parallel to the z axis onto the screen from a point on the object. You are forbidden to read further until you are satisfied that you have visualised this correctly.

Transformations

Having defined an object by noting the x,y,z coordinates of as many points as are required, it is possible to perform various *transformations* on the object by


LORD OF THE RINGS
GAME ONE
"The most advanced, original and involving adventure you will ever play... Without peer in terms of scope, imagination and involvement." - Popular Computing Weekly
LORD OF THE RINGS Game 1 is available on C64, BBC, Spectrum and Amstrad
MELBOURNE HOUSE

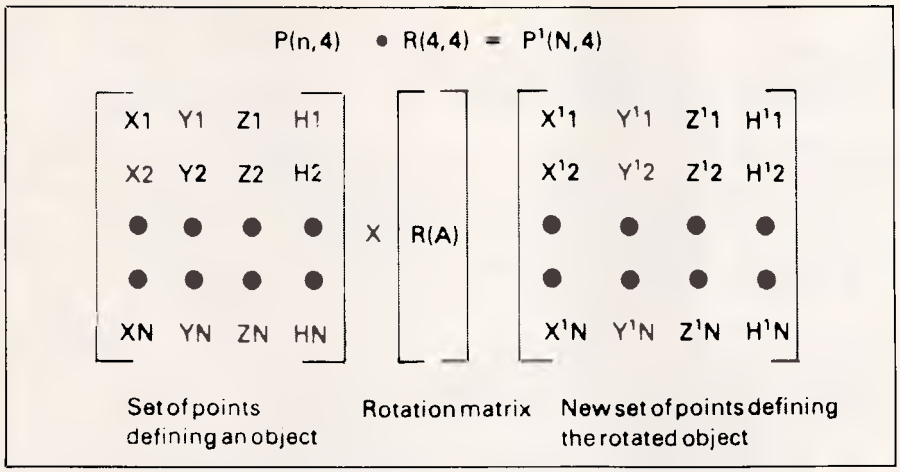


Fig 3 Transformation by matrix multiplication

arithmetic operations on the coordinates of each point. Transformations include rotation, translation, and scaling among others. *Rotation* means rotating the object around one or more of the x-axis, the y-axis, and the z-axis, with the order of operations being specified. *Translation* means moving the object in any of the three directions or a combination, and *scaling* means simply making the object larger or smaller while retaining its position in space. A subset of scaling involves changing the size by a different factor in each dimension, permitting the stretching or compressing of an image. Using negative scaling factors permits generating mirror images. It is also possible to shear an image, to clip it to conform to some defined border, and to map it onto a different surface such as a cylinder or sphere.

To transform the two-dimensional image of a three-dimensional object, it is necessary first to apply the transformation function to each three-dimensional point and then to project the new set of points onto the plane of the screen.

The use of matrices

Matrix arithmetic is used to implement transformations because it greatly simplifies and speeds up both program writing and the actual calculations

```
(A1*A2)+(B1*D2)+(C1*B2)  |  (A1*B2)+(B1*E2)+(C1*H2)  |  (A1*C2)+(B1*F2)+(C1*I2)  |
(D1*A2)+(E1*L2)+(F1*B2)  |  (D1*B2)+(E1*E2)+(F1*H2)  |  (D1*C2)+(E1*F2)+(F1*I2)  |
(B1*A2)+(H1*D2)+(I1*B2)  |  (B1*B2)+(H1*E2)+(I1*H2)  |  (B1*C2)+(H1*F2)+(I1*I2)  |
```

Fig 5 The product of two 3x3 matrices in matrix format

```
ROW 1 COL. 1   (A1*A2)+(B1*E2)+(C1*I2)+(D1*M2)
ROW 1 COL. 2   (A1*B2)+(B1*F2)+(C1*J2)+(D1*N2)
ROW 1 COL. 3   (A1*C2)+(B1*G2)+(C1*K2)+(D1*O2)
ROW 1 COL. 4   (A1*D2)+(B1*H2)+(C1*L2)+(D1*P2)
ROW 2 COL. 1   (E1*A2)+(F1*E2)+(G1*I2)+(H1*M2)
ROW 2 COL. 2   (E1*B2)+(F1*F2)+(G1*J2)+(H1*N2)
ROW 2 COL. 3   (E1*C2)+(F1*G2)+)G1*K2)+(H1*O2)
ROW 2 COL. 4   (E1*D2)+(F1*H2)+(G1*L2)+(H1*P2)
ROW 3 COL. 1   (I1*A2)+(J1*E2)+(K1*I2)+(L1*M2)
ROW 3 COL. 2   (I1*B2)+(J1*F2)+(K1*J2)+(L1*N2)
ROW 3 COL. 3   (I1*C2)+(J1*G2)+(K1*K2)+(L1*O2)
ROW 3 COL. 4   (I1*D2)+(J1*H2)+(K1*L2)+(L1*P2)
ROW 4 COL. 1   (M1*A2)+(N1*E2)+(O1*I2)+(P1*M2)
ROW 4 COL. 2   (M1*B2)+(N1*F2)+(O1*J2)+(P1*N2)
ROW 4 COL. 3   (M1*C2)+(N1*G2)+(O1*K2)+(P1*O2)
ROW 4 COL. 4   (M1*D2)+(N1*H2)+(O1*L2)+(P1*P2)
```

Fig 6 The product of two 4x4 matrices in list format

(1) Rotation

1.1 R(A): Rotate by A degrees about the x axis.

1	0	0	0
0	COS(A)	SIN(A)	0
0	-SIN(A)	COS(A)	0
0	0	0	1

1.2 R(B): Rotate by B degrees about the y axis.

COS(B	0	-SIN(B)	0
0	1	0	0
SIN(B)	0	COS(B)	0
0	0	0	1

1.3 R(C): Rotate by C degrees about the z axis.

COS(C)	SIN(C)	0	0
-SIN(C)	COS(C)	0	0
0	0	0	1
0	0	0	1

1.4 R(A, B, C): Rotate consecutively about the x, y, and z axes. (This matrix was generated from the previous three by techniques to be described.)

FNA	FNB	FNC	0
FND	FNE	FNF	0
FNG	FNH	FNI	0
0	0	0	1

where:

FNA = COS(B) X COS(C)

FNB = COS(B) X SIN(C)

FNC = - SIN(B)

FND = SIN(A) X SIN(B) X COS(C) - COS(A) X SIN(C)

FNE = SIN(A) X SIN(B) X SIN(C) + COS(A) X COS(C)

FNF = SIN(A) X COS(B)

FNG = COS(A) X SIN(B) X COS(C) + SIN(A) X SIN(C)

FNH = COS(A) X SIN(B) X SIN(C) - SIN(A) X COS(C)

FNI = COS(A) X COS(B)

2) Scaling

2.1 S(a,b,c): Scale x by ratio a, y by ratio b, and z by ratio c. (Let a = 1 and c = 1 if you just want to stretch in y.)

a	0	0	0
0	b	0	0
0	0	c	0
0	0	0	1

2.2 S(d): Change size by ratio d.

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1/d

(3) Translation

3.1 T(u,v,w): Move in x by u, y by v, and z by w.

1	0	0	0
0	1	0	0
0	0	1	0
u	v	w	1

Fig 4 Matrices

involved. Take the case of a cube which is to be rotated about the x-axis by A degrees, about the y-axis by B degrees, and about the z-axis by C degrees. The cube is defined by the eight corner points, which we will identify as x1,y1,z1:...x2,y2,z2:...x8,y8,z8. One hundred and ninety-two calculation steps are required if the task is done step by step without matrix arithmetic.

The alternative is to store the points in a matrix and then multiply the matrix by the desired rotation matrix, all in one operation. This is shown symbolically in Fig 3, which I hope you will agree is somewhat less frightening. Note that each matrix has a name (usually a letter in bold type) and dimensions. Note that the technique is not limited to eight points. Note also that we have craftily inserted h1 through hn, the explanation for which is given below.

'Every point in three-dimensional space can be defined by three measurements in the Cartesian system...

Homogenous coordinates

In order to avoid certain problems having to do with dividing by zero, we use *homogenous coordinates* in matrix work instead of Cartesian coordinates. Four homogenous coordinates replace the three Cartesian coordinates which define the position of a point. The c-point (Cartesian point) x,y,z becomes the h-point x,y,z,1. In the reverse direction the h-point x,y,z,h becomes the c-point x/h,y/h,z/h. Don't worry about it. If you really want to know why, study the recommended background reading (see end of article). Using h-coordinates requires that we set up an N x 4 matrix to store N points. In addition, each transformation function is stored in a 4x4 matrix.

(If your language doesn't have the matrix multiplication function it can easily be added as, for example, a subroutine in Basic. The appended listing, MAT, gives such a routine. While this will not run anywhere near as rapidly as a routine resident in machine language, it is suitable for our purposes as we cannot in any case expect to reproduce the performance of a giant mainframe computer for generating moving images).

MICROTEX 666

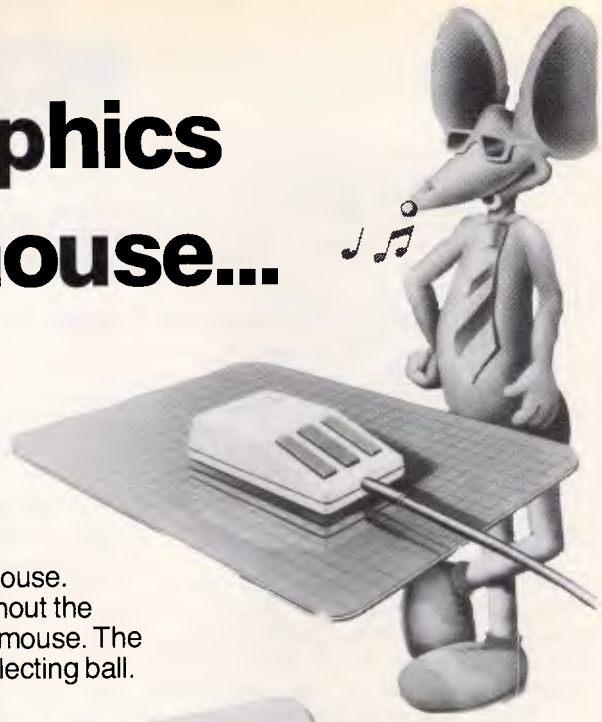
Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

```
100 REM: MATRIX MULTIPLIER BY LINDSAY DOYLE 7/82
110 REM: FOR 25 X 40 SCREEN AND EPSON FX-80 PRINTER
120 REM: CS$ = CLEAR SCREEN: CD$ = CURSOR DOWN
130 CS$ = CHR$(27) + "E": CD$ = CHR$(27) + "B": REM: INSERT YOUR OWN CODES

200 REM: INSTRUCTIONS
210 PRINT CS$; "            MATRIX MULTIPLIER": REM 11 SPACES
220 PRINT "            ____________________"
230 PRINT CD$; CD$; "This program accepts any number of"
240 PRINT CD$; "square matrices of order 6 or less and"
250 PRINT CD$; "computes their product.  It does this"
260 PRINT CD$; "not with numerical values for each"
270 PRINT CD$; "element, but with names of functions,"
280 PRINT CD$; "such as 'SIN(ALPHA)' or '3A + 2B',"
290 PRINT CD$; "which the program handles as strings."

300 PRINT CD$; CD$; "Press any letter key to continue."
310 GET I$: IF I$ = "" THEN GOTO 310
320 PRINT CS$; "If the rows of the resultant matrix"
330 PRINT CD$; "contain few enough characters, the"
340 PRINT CD$; "matrix will be printed out as a"
350 PRINT CD$; "grid.  If the rows are too long for the"
360 PRINT CD$; "printer, the matrix will be printed out"
370 PRINT CD$; "as a list of elements."
380 PRINT CD$; CD$; "Press any letter key to start program."
390 GET I$: IF I$ = "" THEN GOTO 390

400 REM: INPUT MATRIX ORDER.
410 L = 0: F = 0
420 B$ = "                                                ": REM: 40 SPACES, USED IN 860
430 PRINT CS$
440 INPUT "Enter matrix order (2 to 6)"; N: IF N <2 OR N > 6 THEN GOTO 430
450 DIM A$(N, N), B$(N, N), C$(N, N)

500 REM: ENTER FIRST MATRIX.
510 PRINT CD$; "OK. Enter first matrix."; CD$
520 FOR I = 1 TO N: FOR K = 1 TO N
530   PRINT "ROW" I" COL." K": ";: INPUT A$(I,K)
540 NEXT K: NEXT I: GOSUB 900

600 REM: QUASI-MULTIPLY MATRIX IN A$ BY MATRIX IN B$: STORE RESULT IN C$.
605 FOR I = 1 TO N: FOR K = 1 TO N: B$ = ""
610   FOR P = 1 TO N
615     IF A$(I, P) = "0" OR B$(P, K) = "0" THEN B$ = B$ + "0": GOTO 645
620     IF A$(I, P) = "1" AND B$(P, K) = "1" THEN B$ = B$ + "1": GOTO 645
625     IF A$(I, P) = "-1" AND B$(P, K) = "-1" THEN B$ = B$ + "1": GOTO 645
630     IF A$(I, P) = "-1" AND B$(P, K) = "1" THEN B$ = B$ + "-1": GOTO 645
635     IF A$(I, P) = "1" AND B$(P, K) = "-1" THEN B$ = B$ + "-1": GOTO 645
640     B$ = B$ + "(" + A$(I, P) + "*" + B$(P, K) + ")"
645     IF P < N THEN B$ = B$ + "+"
650   NEXT P: C$(I, K) = B$
655 NEXT K: NEXT I
700 REM: COPY C$ TO A$, ERASE B$, C$, READY FOR NEXT QUASI-MULTIPLICATION
705 FOR I = 1 TO N: FOR K = 1 TO N
710   A$(I, K) = C$(I, K): B$(I, K) = "": C$(I, K) = ""
715   IF LEN(A$(I, K)) > L THEN L = LEN(A$(I, K))
720   IF LEN(A$(I, K)) + 3 > 132/N THEN F = 1
725 NEXT K: NEXT I
730 REM: ENTER NEXT MATRIX
735 PRINT CD$; "OK. Resultant matrix has been stored."
740 PRINT CD$; "Is that the last matrix ('Y' or 'N')";: INPUT I$
745 IF I$ <> "Y" AND I$ <> "N" AND I$ <> "y" AND I$ <> "n" THEN GOTO 740
750 IF I$ = "Y" OR I$ = "y" THEN GOTO 800
755 GOSUB 900: GOTO 600

800 REM: FOR EPSON FX-80 PRINTER.
805 REM: ADAPT IT TO SUIT YOUR SYSTEM.
810 PRINT CD$; "OK. Set printer ready and press any"
815 PRINT CD$; "letter key to start printout."
820 GET I$: IF I$ = "" THEN GOTO 820
825 LPRINT CHR$(27); CHR$(64): REM: INITIALIZE PRINTER
830 LPRINT CHR$(27); CHR$(48): REM: SET SPACING.
835 LPRINT CHR$(27); CHR$(82); CHR$(0): REM: US CHARACTER SET.
840 LPRINT CHR$(15); CHR$(27); CHR$(71): REM: CONDENSED ON, DOUBLE STRIKE
845 IF F = 1 THEN GOTO 1000 : REM: PRINT IN LIST FORMAT.
850 REM: F = 0 SO PRINT IN MATRIX FORMAT.
855 FOR I = 1 TO N: FOR K = 1 TO N
860   LPRINT A$(I, K) + LEFT$(B$, L - LEN(A$(I, K))) + " " + CHR$(124) + " ";
865   REM: CHR$(124) IS VERTICAL BAR
870  NEXT K
875  LPRINT CHR$(13); CHR$(10): REM: CARRIAGE RETURN, LINE FEED AS REQUIRED.
880 NEXT I
885 PRINT CS$: END

900 REM: SUBROUTINE FOR SECOND OR SUBSEQUENT MATRIX.
910 PRINT CD$; "Enter next matrix."; CD$
920 FOR I = 1 TO N: FOR K = 1 TO N
930   PRINT "ROW" I " COL." K ": ";: INPUT B$(I, K)
940 NEXT K: NEXT I: RETURN

1000 REM: PRINT IN LIST FORMAT
1010 FOR I = 1 TO N: FOR K = 1 TO N
1020   LPRINT "ROW" I " COL." K; A$(I, K)
1030   LPRINT CHR$(13); CHR$(10)
1040 NEXT K: NEXT I
1050 PRINT CS$: END
```

Listing 1 Matrix Multiplier

It took Summagraphics to build a better mouse...

...and no traps!



For over a decade Summagraphics has lead the way in the advancement of computer graphics. For example our new optical mouse has eliminated all the traps of the mechanical mouse.

Summamouse will remain accurate and run for years without the continual maintenance required by the outmoded mechanical mouse. The reason? It uses infra-red sensors instead of a dust and fluff collecting ball.

Technically or creatively—with stylus or cursor—you can draw on our experience.

Another Summagraphics first was the ID – intelligent digitizer. The original and best selling digitizer in the world. Our latest marvel of technology is the high performance Microgrid Series. Combining high resolution, accuracy and reliability Microgrid systems provide thin lightweight tablets in sizes from 508 mm x 508 mm (20″ x 20″) to 1067 mm x 1523 mm (42″ x 60″) and with a choice of one button stylus or 4 or 16 button cursors. A variety of interfaces are available including IEEE-488.

Once again Summagraphics was first to anticipate user needs with the Bit-Pad.

The MM Series is designed to offer maximum performance at minimum cost. It performs all cursor steering, menu picking and graphic tasks. This comprehensive series features three tablets. 152 mm x 228 mm (6″ x 9″), 297 mm x 297 mm (11.7″ x 11.7″) and 305 mm x 457 mm (18″ x 12″). The MM Series is compatible with all leading micro computer CAD programmes including auto CAD.

We even have a tablet designed especially for the Apple Macintosh. The MacTablet. The pen-like stylus makes it as easy as putting a pen to paper. Just plug it in and draw.

Summagraphics tablets are available only from Minicomp, Australia's most up and coming computer company.

So you've got our experience to draw on, too!

Phone us now
(02) 957 6800

Minicomp (Inc. in NSW)
104 Mount Street,
North Sydney, NSW 2060.
Telex: AA75774

```
100 REM: MAT SUBROUTINE TO MULTIPLY ONE MATRIX BY ANOTHER.
110 REM: THE MATRICES ARE A(I,J) AND B(J,K).
120 REM: THE NUMBER OF COLUMNS IN A MUST EQUAL THE NUMBER OF ROWS IN B.

200 FOR ROW = 1 TO I
210   FOR COL = 1 TO J
220     DATA = 0
230     FOR CASE = 1 TO K
240       DATA = DATA + A(ROW, CASE) * B(CASE, COL)
250     NEXT CASE
260     C(ROW, COL) = DATA
270   NEXT COL
280 NEXT ROW
290 RETURN
```


Listing 2 Matrix Multiplier

Combining transformations

Even if your language has a matrix multiplication operation, each such operation takes a certain amount of time, and if you want to combine several transformations in a row, the time required is the sum of the times for each. A typical Basic interpreter might take a second or two to do a rotation of an eight-point figure.

For this reason it is rewarding to note that two or more 4x4 transformation matrices can be combined to generate a single new 4x4 matrix which carries out all the functions of the original matrices but is easier to store and will compute more rapidly. In this connection it is important to realise that the order of computation makes a difference. In ordinary multiplication, AxBxC is the same as BxCxA: this is not the case in matrix multiplication.

A good example is the problem of rotating about the centre of an object rather than about a point on one of the axes. This is done by first translating the centre of the object to the origin, then rotating the object, and then translating it back to the original point. If you visualise this process, you will see why the correct sequence is essential.

At this point and before continuing to show how matrices can be combined, we should introduce some of the actual matrices which will be found most useful. These are shown in Fig 4.

A matrix multiplier

How can we generate the product of two or more matrices so that the computation of commonly-performed transformation sequences, such as rotation about an arbitrary point, can be optimised?

What we have to talk about is symbolic manipulation of functions of a variable. The ordinary Basic in most micros doesn't know what you want when you start off without any other preliminaries and ask it to PRINT A*X 2 + dB*X + C. The response will be 0, since the computer assumes that A,X,B, and C are variables to which no value has yet been assigned. Similarly, the instruction PRINT Y/X will generate a 'division by zero error'.

But what do you do if you want to find out what the symbolic result of manipulating a number of functions is without giving actual values to the functions? What is needed in our case is one new matrix which is the symbolic product of several transformation matrices. The elements of the matrices are terms like SIN(A), COS(A), x/2, y/2, and a scattering of 1s and 0s, but we don't want to solve yet for specific angles and x want to generate one composite matrix statement to put in a program which can then be solved for whatever angles and xs the program presents it with. Not being a professional programmer, I don't know whether the technique I use is innovative, but I have never seen it elsewhere, so I shall describe it here.

The program

The appended program, Matrix Multiplier, accepts any number of matrices in symbolic form and 'computes' the resultant product of them all. The matrices must be square and of six or fewer elements on a side as the program is written, but neither of these requirements are fundamental limitations to the technique. Since it is written in a standard form of Basic and reasonably well-annotated, you should be able to adapt it to the quirks of your micro with no trouble.

What we want to be able to do is to input a term like COS(A) and a term like SIN(B) and come up with the expression COS(A)*SIN(B) without regard to the values of A and B. The way the program does this is by treating the functions as strings and using string manipulation operators. For example, let's assume that the term COS(A) is the 1,1 element in string matrix A$(4,4) and that SIN(B) is the 2,2 element in matrix B$(4, 4). If it is desired to write their symbolic product in, say, cell 3,3 of matrix C$(4, 4), we can do this by the command C$(3, 3) = A$(1, 1) + "*" x B$(2, 2). That's all there is to the idea. You may ask what's all the applause and why go to the trouble, but you wouldn't if you had tried to multiply six 4x4 matrices by each other and keep track of all the six times sixty-four results. The sample program printouts shown in Figs 5 and 6 will give you a feel as to why it is almost impossible to do the job manually, in a finite time, without generating errors.

The program just does the string concatenation for what I call 'quasi-multiplication': it doesn't actually do any arithmetic. Even if an element of the resultant matrix equates to 0 or 1, it is still printed out as the sum of all its components. Therefore it's up to the user to examine and modify the printout. For example, one of the terms in a test I ran was printed as "(D*L*1+F*M*0+0*0+−F*N/Z*0)*0". I had to scan this and determine that the total expression evaluated to zero. This is a small price to pay for the time-saving and error-free results that are available, however.

The printout

The printout portion of the program was set up for condensed characters on the Epson FX-80 printer, which gives up to 132 characters per line. If the program sees that it can print the actual matrix across the paper, it will do so, thus generating a neat grid display (see Fig 5).

However, if it sees this is not possible, it will revert to printing out the coordinates and contents of each cell on a separate line or on more than one line if necessary (see Fig 6). Obviously this approach can be modified to suit the characteristics of your printer. I think that the rest of the program should be self-evident or interpretable from the remarks.

Conclusion

A short introduction to some of the more useful matrix transformations has been provided. Two new ideas have been presented: the concept of using string operators to combine functional expressions in matrix multiplication (or elsewhere), and the concept of having a program change the printer format as a function of the amount of data present.

If anyone wants to claim prior invention, he is welcome to, but as I have not seen either described in the microcomputer press to date, I hope that they may be useful to someone.

Background reading: Microcomputer Graphics *by Roy E Myers, Addison-Wesley Publishing Co 1982.*

Australia's fastest import route.

It can cut up to four days off your import route.

All that you require is a personal computer, telephone, and the communications hardware and software.

And documentary credits can be established in a day.

Avoiding time-consuming paperchases that most banks make you go through.

The long name for this short route is the Commonwealth Bank's Computer Initiated Documentary Credit Service.

Or, as we prefer, CIDOS.

Just type in your password and requirements, and we'll do the rest of the work.

You save time, the high risk of human error, and money, by being more precise in the timing of transactions.

Considered in the light of shipping delays and all the other barriers to the expediency of your import business, CIDOS is a timely innovation indeed.

Contact the Commonwealth Bank today.

Getting CIDOS is almost as easy as using it.

COMMONWEALTH BANK.

Australia's leading bank.

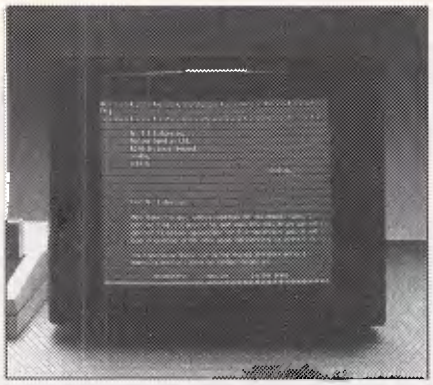
Graham Pack, Sydney (02) 238 5030. Karen Higginbotham, Melbourne (03) 616 4226. Ray Weale, Brisbane (07) 226 3692. Ian Lowry, Canberra (062) 49 6133. Dean Woolman, Adelaide (08) 510 401. Max Ayre, Perth (09) 326 4636. Baden Miller, Hobart (002) 38 0182.

CB761

BLAKEHURST COMPUTER COLLEGE

THE MASTER 128 is the foundation stone of the BBC Microcomputer Master Series and embodies the key concept linking the whole range: usefulness.

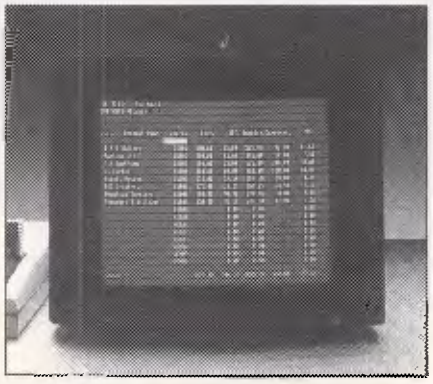
For a start it's a word processor. The Master 128's professional typewriter keyboard and powerful word processing software enable you to prepare reports, essays and letters which are word perfect.



The Master 128 comes complete with VIEW 3.0, the latest and most sophisticated version of one of the best selling word processing packages on the market.

It's also a spreadsheet calculator. The popular and easy to learn spreadsheet program is ideally suited to applications involving budgetting, planning, estimating or any repetitive calculations.

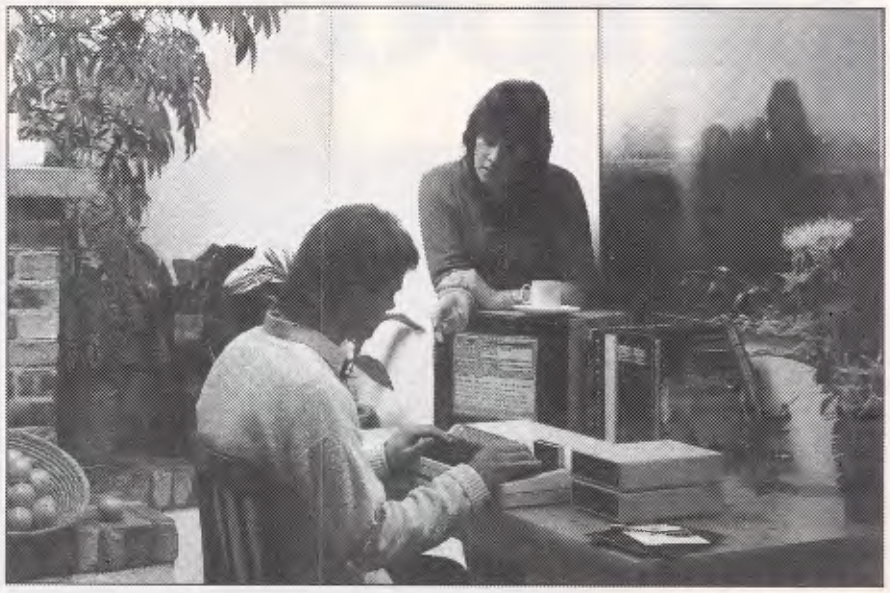
Both these programs are provided in the computer's read-only memory making them instantly accessible. In addition, thousands of other programs are available covering applications from backgammon to business. Existing ROM-based software can be added to your Master 128 in seconds using an optional EPROM cartridge inserted in one of the two plug-in cartridge sockets.

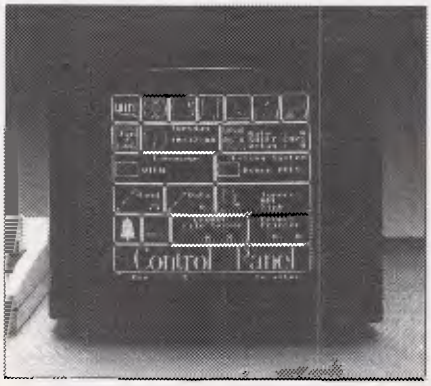


VIEWSHEET, the Master 128's spreadsheet program, was described by the magazine A&B Computing as 'a spreadsheet of very considerable power and an excellent business tool'.

The sophisticated graphics facilities of the Master Series are ideally suited to computer-aided drawing and design or for the computer generation of graphs, charts and diagrams. Rectangles, circles and ellipses can be drawn with speed and ease, and a choice of 6 billion shadings, textures and patterns is available to stimulate your creativity. For aspiring musicians, the Master Series can be used for composition and performance.

If your interest is in creating your own programs, the Master Series provides you with the latest version of BBC BASIC, widely regarded as the best BASIC around. Many other programming languages are available and all graphics, sound and operating system commands can be used by these other languages. The Master Series gives you easy access to assembler programming through BBC BASIC. Program and text editing facilities simplify your program development whilst the open design of the Master Series operating system gives maximum scope to your ingenuity.





Using the unique Control Panel utility you can configure your Master Series Microcomputer so that it starts up ready to use in the way you choose. The Control Panel can also be used to set the Master's real-time clock.

To complement its versatility, the Master Series provides a unique configuration utility. Using an icon-based Control Panel you select the functions you require from your micro at start-up: the application you want to run, the screen display mode and so on. This information is stored in battery-backed programmable memory. As soon as you switch on your computer the commands are carried out, making your Master Series Microcomputer ready to use immediately for programming, as a word processor or whatever you wish.

As you would expect with a computer that places such emphasis on usefulness, your Master Series Microcomputer comes with everything needed to get you using it quickly and effectively: a Welcome Guide introducing you to the machine and its facilities; reference cards to VIEW and VIEWSHEET; and a Welcome cassette and disc of programs to make your new micro run through its paces.

Now Available from:

NSW

Blakehurst Computer College
647 Princes Hwy
Blakehurst
(02) 546 7399

Kawacom
64 Exmouth Rd
Kanahodka
(042) 61 4856

VICTORIA

East-West Electronics Pty. Ltd.
117 Smith St
Fitzroy
(03) 419 9533

Q&A

Q&A is an inexpensive integrated word processing and database system, but with a new component — an artificial intelligence front-end to the database which allows information to be retrieved, analysed and updated all through the use of natural English. Ian Davies takes a look.

Q&A is more than just a natural language query facility. It is obviously attempting to meet just about all the needs of a business PC user in one fell swoop, by covering the two major business activities, namely word processing and database. It does not go so far as to encompass spreadsheeting, which might be a wise move given the big players in the spreadsheet market. It does, however, provide the ability to import and export data files from and to other spreadsheet packages.

Given that the purchaser of Q&A is supposed to use Q&A as his main database and word processor, as well as being a neat piece of software to hold a conversation with, he had better make sure that Q&A performs adequately in all areas.

Overview

Q&A is delivered on five floppy disks, including a tutorial disk. Its main menu provides access to its five major subsystems. Since Q&A is all the one product, the behaviour of the menus in all situations is consistent, involving simply moving the cursor to the desired item, or entering an initial letter or number. Throughout Q&A, the F10 key provides a "continue" function, and the F9 key allows backtracking but only in some circumstances. The ESC key universally means "quite".

The main menu provides access to a file function, which allows new databases to be designed, old ones redesigned, records added, deleted or updated, and also simple reports to be generated. For more complex reports, the "report" option from the main menu allows control over sorting and derived fields, and allows these report specifications to be stored on disk. It is these two options which comprise the database.

The "write" option from the main menu invokes the word processor, while the "utilities" option allows the user to import and export data, define printers and manage disk files.

The last of the menu options invokes the Intelligent Assistant — the natural language query system. As user friendliness is the name of the game in Q&A, you even get the opportunity to rename this function to anything you like.

The Intelligent Assistant interfaces with the database facilities of Q&A, not the word processor, so although Q&A is "integrated", it is only loosely so.

All functions are heavily overlayed, and so moving from one feature to another is accompanied by much grinding of disks. When running on a floppy based system, Q&A will display a window to indicate which program disk should be placed in drive A before proceeding. Unlike some products which work this way, you do get the opportunity to back out when it is asking for a new disk.

Help information is available in almost all situations, universally accessed through the F1 function key. Although nowhere near as detailed as Lotus help screens, they do provide page number references into the manual.

One final function of Q&A which does not rate a routing off the main menu because it is available in all contexts is the "macro" facility, which allows any key to be redefined to a string of characters.

Word Processing

The word processing facilities of Q&A fall more into the category of what I call "memo makers" than a professional word processor. Its features are relatively spartan, but are very easy to use. The entire document is kept in memory, which means that there is no delay in moving from one page to another, but it does place limits on the maximum size of a single document. To combat this limitation, Q&A allows documents to be linked.

Like most word processors for the IBM PC and clones, the cursor keys provide basic navigation around the document, and can be combined with the Control key for cursor movement. Similarly, the Page Up, Page Down, Home and End keys perform their 'standard' functions. The End and Home keys in particular are interesting as pressing them a number of times will move the cursor to either start or end of line, screen, page or document.

The word processor can be run in either insert or overtype modes, depending upon preference, and provides the ability to recover deleted text, with the usual caveats. Advanced facilities are accessed through a couple of function keys, several of which invoke menus overlayed on the document. Blocks of text can be copied, moved and deleted, even into files. Printing enhancements are selected through a submenu and include options such as bolding, underline, italics, subscripts and the like. These enhancements work a little differently to most word processors, For example: instead of selecting an option, typing some text, and then deselecting the option, you select the option and then highlight an area of text to be affected. In other words, it is designed to enhance existing text rather than text being typed.

Tab stops are predefined, but indents (called temporary margins) can be set at any position. A search and replace facility

It asks you how many forms it should print on each page, and defaults to "one". I wanted to tell it "just as many as you can fit" (I tried entering an asterisk), but it really wants to be told.

is provided which is case independent and can be run either in manual or automatic modes. All searching can make use of some powerful wild card characters, a rare but desirable feature in a word processor.

One of the most interesting options is the draw mode. This allows for the delightfully simple creation of boxes and any other straight line diagrams. When in draw mode, the cursor keys leave a trail of a continuous line, with corners and junctions automatically generated.

Simple headers and footers can be created which can optionally include page numbers. A very flexible mail merge function is provided which interfaces well to the database system. This includes features such as justification control, record selection and sorting. Merging can only be done from the database.

A "Define Page Characteristics" menu allows control over the document margins, page length, starting page number and characters per inch. Q&A happily works with documents wider than 80 characters by scrolling horizontally in a sensible manner. Word wrap is 'on screen', while justification is not, and must be activated from the "Print Document"screen. Changing the margins automatically results in the entire document being reformatted.

The Q&A word processor works on the 'current workspace' concept, and so documents must be Got and Saved before and after going into Type/Edit. Documents can also be Exported into simple ASCII format, although they cannot be read into the database system unless you have cleverly formatted your data in one of the recognised standards.

And that's all there is to the Q&A word processor. It's not much, but then it doesn't pretend to be a professional grade processor suitable for writing books. Experienced stand-alone word processor operators might sneer at it, but it provides all of the essential functions in an easy-to-use format.

Database

Alas, Q&A is yet another example of a database that isn't. I guess it all depends on what you mean by "database", but the manual even hints at the reality of the situation by calling records "forms". This won't be a problem to many users, but to others will make Q&A just not feasible for any but the simplest of applications.

The main shortcoming in the database is the lack of relationships. Every file is viewed as a series of forms, each of which contains the same set of fields as identified by name. The problem is that files cannot be interrelated. For example, assume you wanted a file of contacts, where each contact person in your database worked for a particular company, and in some cases there might be many contacts who all work for the same company. In a real database system, you would only need to define that company once, and all of its contacts would be related back to the company details which are recorded in one place only. This not only makes for efficient storage and accuracy in answering questions such as "how many companies are there", but also makes updating company details much easier. Unfortunately, Q&A provides no such ability.

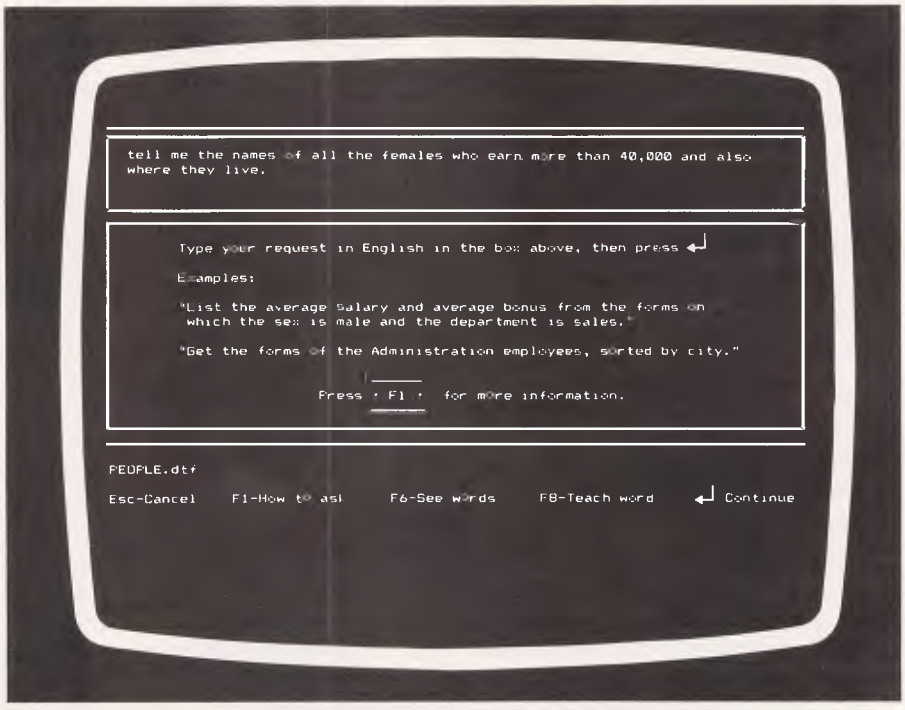
Another scenario which sorts out the database managers from the file systems is where you have an employee file and want to record each employee's top five skills. In a real database system, you can define a field called "skills" and say that it occurs five times (or some equivalent method, but they can all do it), whereas in Q&A you would have to define fields called "skill1", "skill2" through to "skill5". This makes searching for a particular skill very messy, and also makes questions such as "who has the most skills" and "who has no skills" extremely difficult. The workarounds to these limitations are not insurmountable where formal query languages are concerned, but when the queries come from a natural language system, often seemingly simple tasks just cannot be done.

The 'database' does, however, support indexes — which many file managers do not. These indexes are essential for the Intelligent Assistant to do its stuff, as we shall see later.

Actually, all is not bad news in the database area, the product provides many rare and wonderful features. A database is designed from a blank screen simply by moving the cursor around and typing field names followed by colons. Field lengths are indicated by a ">" terminator. The fields and their labels can be laid out in any format desired, and 'draw' characters can even be used. Once the form is complete, Q&A asks you the data type of each field, which may be one of text, number, money, keyword, date, time or yes/no. Finally, Q&A asks you some general questions pertaining to the entire field, such as how money values and dates should be displayed. In its most simple form, this is all that's required to design a database.

The date data type is particularly neat, as although they are always displayed in the selected format, they can be entered in the data entry screens in almost any unambiguous format, for example, "23 2 86", "23 2 1986", "23 Feb 86", "Feb 23 86", and so on. If the date is ambiguous, such as "8 2 86", Q&A resolves the month from the day on the basis of the display format selected. If the date entered is totally unintelligible Q&A will display an error message and ask the operator to correct it.

To redesign the file at a later date, even after information has been loaded, it is simply a matter of moving the cursor around and editing your design. What



The Q&A question screen

FEATURES?
ADI comes through with flying colours

The range of monochrome and colour monitors by ADI offers every feature you've ever wanted in a computer monitor.

Not only are the colours brilliant, but their displays offer extremely high resolution. ADI's **14" screens** are 30% larger than standard monitor screens and a **tilt/swivel base** is **included** in the price.

In addition, ADI has two Super HiRes colour monitors. The PX-22 which is compatible with IBM's Enhanced Graphics Adaptor and the PX-32 which is compatible with IBM's Professional Graphics Adaptor.

For superior monochrome and colour monitors call ROY BAKER or COLIN EADIE at Imagineering. They can prove that when you compare the value packed features of ADI monitors, all other computer monitors are.....for the birds!

IMAGINEERING™

SYDNEY
Imagineering
77 Dunning Avenue, Rosebery NSW 2018
Phone: (02) 662 4499

AUCKLAND
Imagineering Micro Distributors Ltd
86 Wairau Road, Takapuna, Auckland 10
New Zealand. Phone: (09) 444 5088

ADI

could be easier?

Designs can also be more comprehensive, including formatting (justification, commas, etc), validation through range or enumerated expressions, default values, indexes, customised help for each field, screen attributes, and even a special facility called "program form", which allows simple calculations and rules to be followed as the cursor is either moved into or out of each field. A lookup table can be defined, although only one of these may exist for each database, which could be quite a restriction in some applications.

The manual recommends that the user should not get too carried away with indexes on large files, where they consider large to be more than 100 records. I loaded up a file with several hundred records and performance did not degrade too badly, but it sounds as though megabyte databases with a dozen indexes are probably off limits for Q&A.

Included in the database area of the product is the ability to add, update, delete and search for data. This brings the form upon the screen in exactly the way you designed it and provides a couple of function keys for actions such as browsing and the like. The search capability is quite comprehensive, and is found throughout the product, such as in the mail merge feature. Search requirements are expressed in a blank form, in which fields are filled in with search criteria. In their most simple form, this might just be a value, for example, typing "Smith" in the name field would search for just those employees whose name is "Smith". The criteria can actually be quite complex, as a whole set of relational operators are provided. What it cannot do, however, is ORs between fields, for example, you cannot retrieve all those people whose sex is female or whose salary is greater than $35,000. Similarly, you cannot compare two fields, for example: print all the people whose bonus is greater than their salary.

In searching, a set of sort conditions can also be expressed. Again this is done by presenting the user with a blank form. The user simply moves the cursor from field to field, placing a "1" in the field he would like to be the major sort, a "2" in the next one, and so on. The numbers can also be followed by option characters to indicate the direction of the sort.

A print facility allows the user to specify selection and sort conditions, and then arrange the fields either down the page, across the page, or individually at 'x,y' co-ordinates. This is not the main reporting feature of Q&A, though it provides the greatest formatting flexibility. Its major downfall is that it asks you how many forms it should print on each page, and defaults to "one". I wanted to tell it "just as many as you can fit" (I tried entering an asterisk), but it really wants to be told.

The last major database feature is the mass update. This allows you to specify a selection condition and a set of updates to be applied to every record which passes. The update specification may be as simple as a new value, or can be a formula. Throughout Q&A, to use a formula which references other fields, you cannot just mention field formula which references other fields, you cannot just mention field names, instead you must move the cursor from field to field and place a hash sign (#) followed by a number in each field you plan to reference. The formula is then of the form "#3 = #1 + #2 * 1.1".

Q&A can handle files of up to 16 million records, each of which can be up to 16,780 bytes in length and contain up to 2400 fields with up to 115 indexes, although I suspect performance may become a problem before these limits are reached.

Report

Although Q&A provides the Intelligent Assistant for ad-hoc queries, for more formal reports the Report option is used. This facility allows report formats to be stored on disk and used on a regular basis.

Report specification commences with a normal selection screen, with all its normal limitations. A blank form then appears and the user places numbers next to the fields he wants on the report, in the order he would like to see them. Sort indicators can also be added, including actions to be taken on a sort break, such as totals, maximums, minimums and averages.

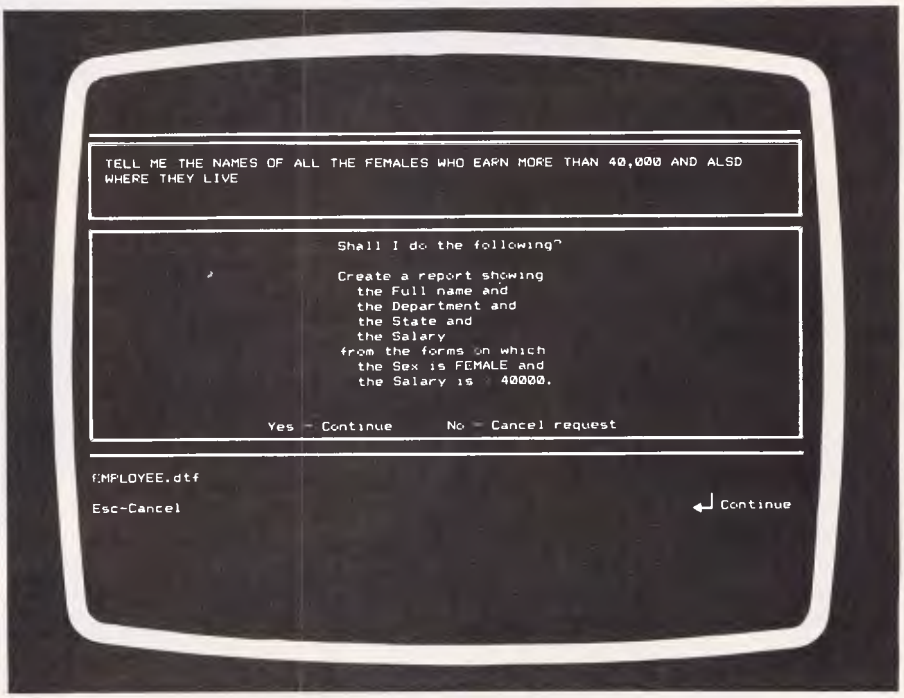
Derived columns can be generated on a special screen which defines their heading, column position and formula. As always, the formula is expressed using column numbers, rather than field names.

When the report is finally run, the user has the option to request "totals only", in which case a summary report is produced. Page headings and footings can be specified and can include automatic page numbers, date and time, although only one line is available to each. Before actually running a report, one-time changes can be made to the specification.

The weakest aspect of the report facility is its lack of format control. Records can only occupy one line each, with no subheadings or subfootings. Thus all the information you want to display must be able to fit across the page. If the report format exceeds the page width, Q&A gives you the option to either cancel or carry on regardless — there is no panelling.

Intelligent Assistant

So far, Q&A has few features which set it apart from the hoards of similar products. The one facility which is, however,



Q&A describing its plan

MICRO-PRO COMPUTERS

PERICOM ENGINEERING CO

43 Atherton Road, Oakleigh, Victoria 3166

***** ALL PRICES INCLUDE SALES TAX *****

PC/XT SYSTEM I

$1390

640K RAM-dual disk drive, colour graphics video card, 2 serial/1 parallel port, joy stick port, real time clock, 150 watt power supply.

PC/XT SYSTEM II

$1240

256K RAM single disk drive, colour graphics video card, 2 serial/1 parallel port, joy stick port, real time clock, 150 watt power supply.

PERIPHERALS

	$
Hercules Graphic Cards	199
512K RAM cards OK RAM	99
Multifunction Card OK RAM	199
Video cards	169
RAM chips/per 64K	19
RAM chips 256K	79
Drives 5" 360K PC	249
Drives 5" Slim Apple	199
Drives 5" Fat Apple	209
IBM Disk Controller	139
IBM Hard Disk Controller	399
Controller for Apple	75
Mouse	197
Joystick	45
Centronic Cable	29
Z80 Cards	79
Parallel printer card	89
Grappler card	83
80/40 column card	120
16K RAM cards	89
128K RAM cards	180
R.G.B. colour cards	82
PAL colour cards	82
Clock cards	163
Speech cards (SAM)	55
Eprom burner 16, 32, 64	92
Super serial RS232	125

MODEMS

$199-$495

V21-V23 Bell 103-203 connects to bulletin boards, 300 full duplex, connects to Viatel 1200/75

V21-V22, 300-1200 full duplex auto answer dial (hayes)

BAUD RATE CONVERTER

	$
Splits baud rate to allow connection to Viatel	200

SOFTWARE

	$
DBase III	795
Lotus 1-2-3	799
Symphony	850
Wordstar pro	595

MAINTENANCE

	$
Extended warranty 12 months on computer	175

MONITORS

	$
12" green screen	195
12" Taxan SuperVision III	770
14" D.T.X. R.G.B. monitor	449

PRINTERS

	$
Daisy Wheel (Brother)	from 450
80 col. dot matrix	from 399
132 col. dot matrix	from 700

HARD DISK DRIVES

	$
10 meg with controller	999
20 meg with controller	1350

Phone 03 568 6911, 03 569 5450

Telex No 32679 (Basis)

*IBM is a registered trademark of International Business Machines
Apple is a trademark of Apple Inc.

likely to make housewives and footballers rush out to buy it is the Intelligent Assistant.

The Assistant basically provides a subset of the functionality found elsewhere in the product, but provides it through a natural English interface.

The first step before using the Assistant is to let it review the contents of your database. This is described in the manual as being a lengthy process, and it's true. On an IBM AT running a hard disk, a file of 400 records took about 20 minutes to be reviewed. The manual actually recommends that the user sets this going before retiring to lunch. Fortunately, this process need only be done once, and the user is advised what percentage of forms has been processed throughout the review.

After Q&A has had the opportunity to rifle through your data, it must then be taught about your database. This is done in eight simple lessons, which include imparting to it items such as words which describe what the database is all about, which are the key fields, which fields contain locations and which are people's names, supplying alternative field names and indicating the units of measure for number fields. Additionally, adjectives can be defined for numeric fields. Q&A already knows adjectives such as biggest and smallest, but will not know any application specific adjectives. Finally, you can also define your own verbs, which appear to be just more field aliases.

Once the teaching process is complete, you can start to ask Q&A to do things. Questions fall into one of a number of categories, being 'what', 'who', 'where', 'how many' or 'are there' questions. The type of question governs the processing performed and the fields displayed in the result. Once a question has been entered, Q&A converts it to upper case and begins parsing, using a bar of reverse video to show how far it has got and what backtracking is taking place. The parsing process takes about ten seconds on a IBM AT with a hard disk. Once the parsing is completed, Q&A displays its 'plan' for your approval. The plan usually says something like "Shall I do the following: create a report showing last name and first name where the sex is f"? At this point, the user has the opportunity to ensure that Q&A has understood correctly, and either give it the go-ahead, or cancel. This form of echo is a crucial feature in any natural language package, as it is a simple fact that only a certain percentage of questions will be interpreted correctly. While this percentage is usually very high (maybe 95%), it is essential that the incorrect interpretations be spotted.

```
What is the average salary of salesmen in Melbourne ?

Who has more than 30 days vacation ?

How many girls live in Victoria ?

Where does Smith work ?

Does Smith earn more than Jones ?

Who earns less than $10000 ?
Raise his salary by 10 percent.

Create a new form.

Add $500 to Bill Smiths salary.

Change the bonus factor in Admin to 0.05

Erase any forms with salary blank.

What's 1 plus 1 ?

Show all the salaries times 1.1

Who earns more than Smith ?
```

Table 1: Sample Q&A requests

While Q&A is by no means strong on ambiguity handling, it does cater for ambiguities between values in the data, user defined fields and predefined English words. It does not allow, however, two field names to be the same, and makes no attempt at resolving ambiguities based on context, simply asking the user for clarification at each decision point. Some examples of Q&A questions are listed in Table 1.

Like most natural language systems, Q&A cannot handle the complexity which a hand coded procedural program could. For example, it cannot perform customised formatting, it cannot do comparisons (for example, compare the average salary in sales to accounting), it cannot redirect its output to the printer, and so on. It can, however, do something few other natural language systems can do, and that is answer nested questions such as "Who earns more than John does?".

Unlike most natural language systems, it does not support "meta-questions", that is, you cannot ask it to "show me all the fields in the file". If you do, Q&A will display all the fields in all the records, rather than just displaying their names.

Performance on an IBM AT with a hard disk was quite acceptable, but on a floppy based system, the Assistant is intolerably slow. This is due to its constant use of the disk, even in such trivial activities as returning from report output to the question screen. The incessant whirring and grinding means that the delay from one question to another is often up to a minute. While it might be argued that Q&A is really doing something very clever, that still does not make the wait any more entertaining.

As a natural language parser, Q&A does an adequate job. It provides all the necessary features such as the ability to use pronouns to refer back to the previous question, and the ability to perform calculations. As well as the words taught to it in the database 'lessons', the user can also define his own synonyms. These are handled in an interesting way. In most natural language systems, if the word "bachelor" is defined to mean 'sex = m and status = single', then the parser can make the most of the situation and have a ready stored understanding of "sex = m and status = single", simply plugging it into its understanding of the question and thereby isolating it from the problems involved with parsing the rest of the question. Q&A, however, handles synonyms by inserting their expansion text into the question before parsing commences. Thus the effect is exactly as though the user had typed his specification in full. It seems to me that this must make parsing much harder.

Basically, there are two ways to write a natural language parser. One approach simply scans the sentence for any words it recognises and, if it sees a field name, displays that field. If it sees a field value, it generates a selection condition; if it sees a keyword such as PRINT or COUNT, it sets the action to be performed appropriately. Any words it does not recognise, it just ignores. Believe it or not, there are PC products operating on this basis getting rave reviews from American magazines, but the end result is simply not satisfactory, as the product makes no attempt to understand the intent of your query and is not even capable of realising that it doesn't understand the question.

Q&A, and the better natural language

"Isn't it time you spread your wings!"

The Sperry family of PC's provide solutions to almost any computer problem. Whether you need a single unit application or a multi-user network the Sperry PC family has the answer.

The Sperry PC/IT outperforms its major competitors in speed, price and expandability. Features include:

- 512Kb RAM standard or optional 1Mb on main mother-board (expandable up to 5Mb of RAM in 2 steps using slots).
- Intel 80286 microprocessor with switch selectable clock rate, choose 6 MHz, 7.15 MHz or 8 MHz.
- 8 full expansion slots (2 x 8 bit or 6 x 16 bit slots).
- 2 built-in RS 232-C ports plus parallel port.
- 40Mb mass storage option available.
- 1.2Mb floppy disks.
- 256 colour high-resolution graphics.

When you decide on Sperry you get more value through more advanced features, power and compatibility with industry standard software.

The Sperry PC/IT and other members of the Sperry PC family are a brilliant technological advance on other PC's. Quite simply, when you decide on Sperry you decide on more of everything.

QLD	(07) 229 6549
NSW	(02) 887 6777
ACT	(062) 47 5222
VIC	(03) 267 4766
WA	(09) 321 4991
TAS	(002) 233 433

SPERRY
Advancing with Australia

Adrenalin 1698/B

systems, such as the mainframe based Intellect, take the second approach, which involves some elementary parsing. One of the effects of the second approach is that if the product does not understand any particular word, it will ask. While it still may not understand the question, at least it insists that every word in the question is known to it. This generates uniformly better results, but be aware: the computer still does not understand the intent of your question! This means that it cannot answer 'essay questions', that is, questions where either the question is an essay, or where the answer would need to be an essay. For example, "who deserves a pay rise", "which company should I invest in". These questions could be answered, but only if you had provided definitions for the relevant words.

Like most good natural language systems, Q&A has in-built heuristics to perform suffix stripping. This means that if it knows the word "earn", then it will also recognise the words "earns", "earned", "earnings", "earner", and so on. It cannot however, perform complex tense conversion, such as "teach" and "taught".

I compared Q&A to Intellect, a mainframe based natural language system which sells for tens of thousands of dollars. While Q&A can do some neat tricks which Intellect cannot (such as nested queries), overall, I felt that Intellect had a better 'understanding' of questions, and could deal with ambiguities better. Unfortunately, comparing natural language systems is far more subjective than comparing other types of software, and cannot be done on the basis of the number of statements and functions.

The Q&A parser certainly parses English, but it certainly does not really *understand* what is being asked of it. However, the same is true of Intellect.

Miscellaneous

Also provided with Q&A is a utilities menu. This provides elementary disk file management functions such as delete, rename, copy and directory. It also provides the data import features, which will be quite important to anyone who has existing data files.

The idea behind the importing of data is to design a Q&A database to hold the data, and then using the import menu, place a number next to each field to indicate in what sequence the data will be found on the external file. Q&A can import PFS, Filing Assistant, dBase, Lotus, ASCII and DIF files, and can export into just ASCII and DIF. The import facility seems to work well, although rather slowly, and Symantec, the authors, guarantee that Q&A is capable of importing any data in the above formats. If any user has trouble, they need only send their data disk to Symantec, and the conversion will be done for them.

A	AT	COLUMN	DIVIDE	FEW	HELP	LARGE
ABOUT	AUGUST	COMMENCING	DURING	FIELD	HER	LAST
ABOVE	AVERAGE	CONCERN	EACH	FILE	HIGH	LATE
ACCORDING	AWAY	CONSTRAINT	EARLY	FILL	HIM	LEAST
ADD	BE	CONTAIN	EITHER	FIND	HIS	LESS
AFTER	BEFORE	COUNT	EMPTY	FIRST	HOUR	LET
AGAIN	BEGIN	CREATE	END	FOLLOWING	HOW	LIST
ALL	BELOW	DATE	ENTER	FOR	I	LITTLE
ALONG	BEST	DAY	ENTRY	FORM	IF	LOOK
ALPHA	BETTER	DECEMBER	EQUAL	FOUND	IN	LOW
ALPHABETICAL	BETWEEN	DECREASE	ERASE	FROM	INCLUDE	MAKE
AN	BIG	DEFINE	EVERY	GET	INCLUSIVELY	MANY
AND	BLANK	DEFINITION	EXCEED	GIVE	INCREASE	MARCH
ANY	BOTTOM	DELETE	EXCLUDE	GOOD	IT	MATCH
ANYONE	BUT	DESCENDING	EXCLUSIVELY	GREAT	JANUARY	MAXIMUM
APRIL	BY	DETAIL	F	HALF	JULY	MEAN
AS	CALCULATE	DIFFERENCE	FALSE	HAVE	JUNE	MINIMUM
ASCENDING	CHANGE	DISPLAY	FEBRUARY	HE	KNOW	MINUS

MINUTE	ONLY	REDUCE	SOME	THEN	VS	YES
MONTH	OR	REMOVE	SORT	THERE	WANT	YOU
MORE	ORDER	REPLACE	START	THESE	WE	YOUR
MOST	OUT	REPORT	STILL	THEY	WHAT	Z
MUCH	OVER	RESET	SUBAVERAGE	THIS	WHEN	
MULTIPLY	PERCENT	RESTRICTION	SUBTOTAL	THOSE	WHERE	
MUST	PLUS	RETRIEVE	SUBTRACT	THROUGH	WHETHER	
N	POOR	REVERSE	SUCCEEDING	TIME	WHICH	
NAME	POSITIVE	RUN	SUM	TO	WHO	
NEGATIVE	PRECEDING	SAME	SUMMARY	TODAY	WHOM	
NEITHER	PRESENT	SEARCH	SYNONYM	TOP	WHOSE	
NEXT	PREVIOUS	SEE	T	TOTAL	WITH	
NO	PRINT	SELECT	TABLE	TRUE	WITHIN	
NOVEMBER	PRODUCT	SEPTEMBER	TAKE	TWICE	WITHOUT	
NUMBER	QUOTIENT	SEQUENCE	TELL	UNDER	WNEC	
OCTOBER	RAISE	SET	THAN	UP	WNIC	
OF	RANK	SHE	THAT	US	WNRC	
OK	RATIO	SHOW	THE	USE	WORSE	
ON	RECENT	SINCE	THEIR	VALUE	Y	
ONE	RECORD	SMALL	THEM	VIEW	YEAR	

, - ; : % * + = / () = /= < > <> <= >=

Table 2: Q&A Predefined words

Q&A also provides a macro definition facility. As mentioned, this allows any keys to be equated to strings of text, and is active in all environments. It's rather similar to the stand-alone keyboard enhancers, such as Prokey and Smartkey. Macros can be saved to disk, and as they are stored in readable ASCII files, can be edited using the "write" facility.

Documentation

Q&A is supplied with a 'standard packaging' user manual, produced on high quality glossy paper with liberal use of colour. The documentation is very much in the 'Don't Panic' style, but provides a good introduction to computing for novice users. It tries very hard to avoid jargon, and manages this very well. For example, indexed fields are called "speed up searches".

Included with the documentation is a quick reference card. The on-line tutorial actually runs within Q&A, and is of the Lotus style.

In general, the documentation is well laid out, well written and easy to follow.

Conclusion

Q&A seems a little confused. For example, it provides three different facilities for retrieving information from a database, none of which does everything the other two can do. In terms of performance, it's slow. The marketing material describes a "lightening fast word processor", and indeed, this is the only area of the product which runs at a reasonable speed. While the database is not too slow, the inevitable whirring and grinding when moving from menu to menu becomes quite tedious and the speed of the Intelligent Assistant leaves a lot to be desired.

The database facilities, as mentioned, are rather limited, and so Q&A is really only suited to 'card index' applications. But for these, it looks as though it will do the job well, providing many features other database systems wish they had.

The selling point of the product is most definitely the Intelligent Assistant. Although I doubt Q&A can meet everybody's business needs, it certainly can address the low end of their requirements, and can do it in a friendly and logical manner.

Q&A is distributed in Australia by International Solutions, and sells for $499. It runs on IBM PCs, ATs and compatibles, and requires MS-DOS or PC-DOS, and 512k of RAM.

MICRON COMPUTERS AUSTRALIA

Drop in at 75 IRVING STREET, FOOTSCRAY 3011

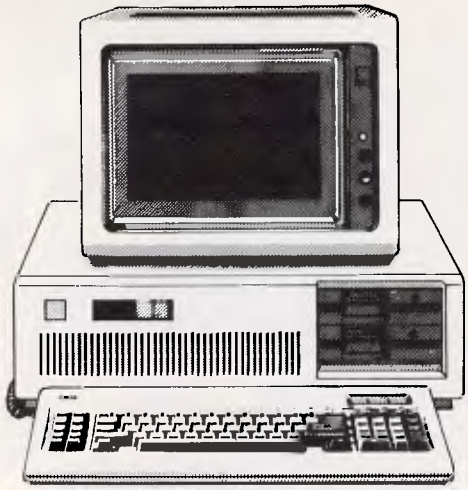
Phone 689 6343, 363 5800 (AH) 689 5461

(Buy Direct from the IMPORTER and SAVE!!)

SPECIALISTS IN SYSTEMS FOR OFFICE, SCHOOLS AND HOME
FINEST IBM COMPATABLE SYSTEMS

★★★ ALL SYSTEMS WITH 6 MONTH WARRANTY ★★★

★★★ ALL JAPANESE COMPONENTS ★★★



All This For **$1999**

MICRON PC/XT OFFICE SYSTEM

* 640K RAM, 8088 PROCESSOR
* 2 DOUBLE SIDED DISK DRIVES
* MULTIFUNCTION CARD WITH SERIAL PARALLEL AND GAMES PORT.
* COLOR/GRAPHICS, MONO CARD
* REAL TIME CLOCK/CALENDAR
* MONITOR ON SWIVEL BASE
* NEAR LETTER QUALITY PRINTER WITH GRAPHICS AND D.M.
* (SEE US ABOUT NETWORKING)

WE'VE CRASHED THE **$1000** BARRIER.

MICRON PC STARTER SYSTEM

* 256K RAM, 8088 PROCESSOR
* 1 DOUBLE SIDED DISK DRIVE
* MULTIFUNCTION CARD WITH SERIAL PARALLEL AND GAMES PORT
* COLOR/GRAPAHICS MONO CARD
* REAL TIME CLOCK/CALENDAR
* INCLUDING A MONITOR!!!

ONLY **$999**

$1600

MICRON PC/XT

* SAME AS THE MICRON PC/XT OFFICE SYSTEM EXCLUDING PRINTER

12 Month Warranty Extension
ONLY **$150**

DISKS OUT THEY GO!!
$20 A BOX OF 10

HARD DISK SYSTEMS TO SUIT IBM

10 MEG. **$899** 20 MEG. **$1099**

WE HAVE A LARGE VARIETY OF ADD ON DEVICES TO SUIT IBM AND APPLE COMPUTERS HERE ARE JUST A FEW

TO SUIT APPLE	$
128K MEMORY EXTENSION	100
5.25" DISK DRIVE	180
3.5" DISK DRIVE	220
DIGICARD PRINT CARD	125
MONITORS GALORE	CALL
EXTENDED 80 COL. CARD	100
MOUSE	99

TO SUIT IBM	$
8087 PROCESSOR	260
DOUBLE SIDED DISK DRIVE	200
JOYSTICK	45
PRINTER CABLE	25
MONITORS GALORE	CALL
MOUSE	135

PRINTERS	$
EPSON LX 80	399
SUPER 5 EP 1201	450
SUPER 5 EP 1000	399
MANY MORE	CALL

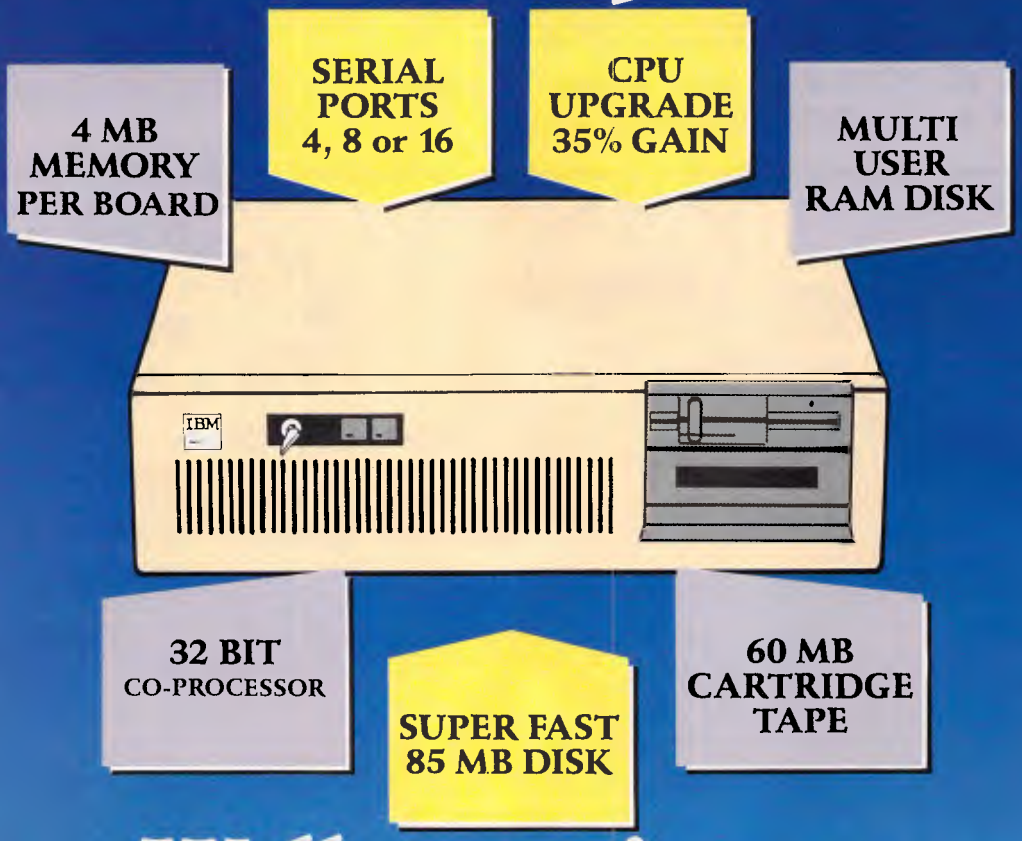
* All Prices Include Sales Tax

MANY! MANY! MORE . . .

NOTE: **DEALER ENQUIRIES WELCOME VICTORIA AND INTERSTATE.**

* DELIVERY AUSTRALIA WIDE
* WE REPAIR ALL MAKES OF MICROS AT REASONABLE PRICES

Isn't it time your IBM PC had these options?



Well now it can

with twice IBM's standard warranty period including accidental breakage, and nationwide on-site support.

These days with good documentation software packages do not take very long to learn. And as soon as you become proficient its natural to want your computer to perform faster. That's where CPU+ can help.

Our goal is to provide powerful cost effective computing. We do this by increasing the central processor and disk speeds which are the usual bottlenecks. Imagine saving up to 75% of the time wasted waiting for your computer. That's probably hundreds of hours in a year but that's what our enhancements can do.

And there's more.

We have options that allow you to connect up to 16 users, disk capacities up to 160MB, a cartridge tape drive, extra memory, graphics and video interfaces, and even a 32 bit co-processor for hefty number crunching. All of our options fit into the standard IBM PC cabinet — no add on boxes and cables.

If these features sound as though they can answer your needs then you're most likely a serious computer user. So we have nationwide on-site service — just like the mainframe guys. But we unconditionally warrant our products for six months including accidental breakage — that's twice the industry standard.

If you would like to see an IBM PC/AT configured with our options and put it through its paces simply call for the address of your nearest participating IBM dealer or Value Added Reseller.

Or call toll free for same day Info mailing.

More info. SYDNEY 319 2223
STD (008) 22 5455

IBM Dealer nearest you
(02) 411 6122

CPU+

CPU plus Pty Ltd
Chatswood Executive Centre
10 Help Street, Chatswood, NSW 2067, Australia
Telephone (02) 411 6122 Telex AA 27220

Pure intelligence nature's way

Many of the current efforts into artificial intelligence involve trying to make a machine perform some particular task in an intelligent fashion, such as playing chess, querying a database, holding a conversation, or drawing knowledge-based conclusions about a very specific subject.

But what is the possibility of developing a "pure intelligence" — one which is not designed to do one particular task, but instead can apply itself to anything? In other words, taking that vital essence which the researchers seek, and instilling it into software in a generalised manner, rather than simulating it through specific programming. As it turns out, it's not that difficult. Indeed, research was undertaken in this direction twenty years ago, but has largely been ignored since.

APC has uncovered this research, and presents it in this article, including a Basic program to illustrate the approach.

In theory, making an intelligence is not so difficult. All you do is get ten billion logic gates, and interconnect them in an extremely complex fashion, and in such a way that they can dynamically reconnect themselves depending on internal determinations. You then connect up some inputs and some outputs, and the result is a *potential* intelligence. The problem is to get the thing started. Known methods include bouncing the device on your knee several times a day, talking to it regularly in a funny voice, and sending it to kindergarten a few years later.

Although no-one has ever actually tried the above experiment, it seems very likely that a true intelligence would be the result. Not just one which is able to parse English sentences or answer questions about diesel generators, but one which exhibits all those traits which at the moment, no computer does.

Let's get one thing clear immediately. It seems as though any serious discussion of man-created intelligence always brings in the subject of religion. I therefore wish to distinguish between a *soul*, which the religious argument maintains people have, while animals and machines do not, and an *intelligence* which people have, and some animals also seem to have, and computers may one day have. Anyone who has seen a seal or dolphin suddenly go into 'problem solving mode' will understand that intelligence is not restricted to man.

How then, do we define 'intelligence'? Most reasonable definitions involve "coping with new situations", and dealing with them correctly. More formally stated, this is "the ability of any decision-making entity to achieve a degree of success in seeking a wide variety of goals under a wide range of environments". Most examples of intelligence we see are related to the real world. Clearly, people need intelligence (or good luck) to build financial empires, design software, stay alive, heal the sick and generally migrate down from the trees and up into condominiums.

Fogel, Owens and Walsh, in 'Artificial Intelligence Through a Simulation of Evolution', a research paper published in 1965, maintained that biological intelligence arose as a result of evolution over the last two billion years. They saw that initially, organisms behaved randomly, and, as time passed, certain species became sufficiently complex to recall the repetition of certain events, and to form a correlation between their actions and various outcomes. Due to the 'survival of the fittest', those organisms which could best model their output based on observed input became the parents of future generations. The ability to survive was measured in terms of how consistently an individual made the proper choice from among the set of available alternatives. This gave rise to man being the dominant intelligent species on the planet.

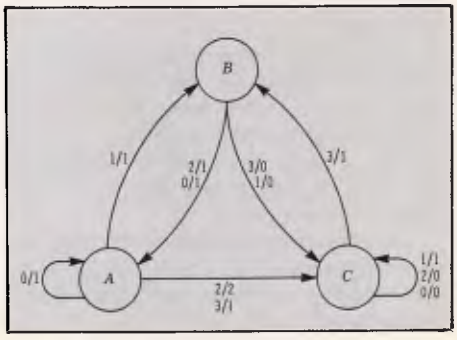


Figure 1: A sample finite state machine

If this all sounds silly, just spare a thought for otters building dams, spiders spinning webs, camouflage the complex social behaviour of ants and bees, the hunting strategies of lions and tigers, and all the other examples of 'specialists' in the animal kingdom.

Fogel, Owens and Walsh maintained that by simulating the process of evolution at an accelerated rate through software, the process of intelligence would also be simulated. Their research

was somewhat abstract, but yielded successful results in a number of different scenarios. The important factor is this: although the test environment and objectives changed throughout their experiments, their software did not — instead it *adapted* to fit the new situations.

Objectives

The object of Fogel, Owens and Walsh was to build a system which, when exposed to a given input environment, could not only learn to model that environment but also predict the future of that environment.

Through the use of finite state machines, the system effectively wrote a program whose output should correspond to the environment being observed. The system then graded how well the program performed, and made alterations to improve its performance. When a satisfactory program had been created, the system could see how well it predicted input symbols it had not yet seen.

Thus the purpose of the system was to recognise patterns, and program the finite state machines to emulate that pattern. So far, it doesn't sound very new or exciting, as pattern recognition has been well researched for many years and whole languages exist which specialise in patterns. The two critical differences are these:

1) No person knew how the solution would be obtained, or even had to understand by what rules the resulting finite state machines worked.

2) The system managed to recognise patterns in sequences for which no known pattern exists.

It's extremely interesting to observe that the progressive results of the system closely resembled the human 'learning curve'.

Simulated synapses

Fogel, Owens and Walsh simulated the effect of synapse networks through the use of interconnected 'finite state machines'.

A finite state machine is a conceptual processor often found within compilers and parsers. They are most easily represented by a diagram, in which the machine is considered to be in one of a number of states (a state being represented by a circle). An input datum from the environment governs which state will be moved to next, and also what output datum to emit. Ideally, the output datum will match the following input datum. This process of changing states based on the input datum continues iteratively. Figure one shows a simple three state machine, in which the environment data may be one of four possible values: 0, 1, 2 or 3.

	Input Symbol			
Current State	0	1	2	3
A	A/1	B/1	C/2	C/1
B	A/1	C/0	A/1	C/0
C	C/0	C/1	C/0	B/1

Figure Two: A table representation of a finite state machine. (Next state/ output symbol)

At any given state the arrows indicate which state to move to upon receipt of a given input symbol, and what symbol is to be output. For example, at state A, if an 0 were observed, the machine would move back to state A and output a 1. Similarly, if a 3 were received at state A, it would move to state C and output a 1. This behaviour can also be represented as a table, as shown in figure two.

A finite state machine is fully defined by either a diagram or a table, as above, plus the specification of its initial state. Once placed in its initial state, the machines behaviour is totally governed by its transition from state to state, and the values observed as input.

These finite state machines used by Fogel, Owens and Walsh are not exactly what finite state machines are generally cosidered to be, as usually the states pass values between each other, rather than observing input (the more traditional finite state machine approach has been used in the program at the end of this article). Often in finite state machines, the results are considered to be the various states the machine passes through; in machines used for this research, the results are described by the output symbols.

As we have said, ideally, the output symbols will perfectly anticipate the following input symbol. Generally, however, this will not be the case, and in order to score the machines predictive ability, Fogel introduced the idea of an 'error-cost matrix'. This matrix indicates the cost of various types of errors, and thus may reflect the situation where every error is equally serious (a miss is as good as a mile), or where some types of errors are worse than others (better to have a false alarm than miss the event). Figure three illustrates two such error matrices. In each case, the horizontal subscript is the machine's prediction, and the vertical subscript is the actual oberved result.

As the machine predicts the input symbols, its answer is scored by a simple array access into the error matrix. These errors are then accumulated and expressed as a decimal fraction. As this error cost decreases, the machine is doing a better mapping of its environment.

[0 1 1 1]	[0 1 2 3]
[1 0 1 1]	[3 0 1 2]
[1 1 0 1]	[3 3 0 1]
[1 1 1 0]	[1 1 1 0]

Figure Three: Two error-cost matrices.

The mutations

The power behind the technique lies in starting with a randomly constructed finite state machine, and slowly mutating it. The mutations may be of the following types:

- Change an output symbol
- Change a state transition vector
- Alter the number of states
- Select a different initial state

The mode of the mutation is selected randomly, and so also are the details of that particular mutation. Once a mutation is complete, the new machine is graded against the same environment and, if it attains a better score, the new machine is retained and the old one discarded. If the old one were better, the new one is discarded and another mutation is applied to the original machine. Each iteration of this process is called a 'generation'.

The question arises when to stop mutating. Ideally, a perfect machine will be developed and mutation could stop at that point, but more likely the error cost will continue to drop and the percentage of correct predictions will rise asymptotically. At any point the iterations can be suspended and the current 'best' machine can be used to make predictions about the next symbol in the input sequence.

Fogel, Owens and Walsh saw that evolutionary programming offered unusual flexibility, in that it could not only be used to predict the input symbols, but it could also be used to predict other parameters of the same input stream, but parameters which could only be measured retrospectively in real life. Additionally, in a real application, the nature of the input stream may subtly alter over time. For this reason, they introduced the concept of a 'recall'. The recall is the number of past input symbols the system can remember and use

SAVE A STACK WITH

COMPUSHACK

(While the stock last)

MLC CENTRE
SYDNEY CITY
(02) 235 2455

1/303 PACIFIC HWY
LINDFIELD
(02) 467 1933

GREENWAY SHOPPING ARCADE
CHURCH ST PARRAMATTA
(02) 635 6020

NEWLY ARRIVED COMPUTERS

You'd be crazy to buy your computer from anyone else without first checking our prices on:—

Apple, Commodore
Sanyo, Amstrad

Sinclair, Olivetti,
Tava, Memotech

Come in and see for yourself our special prices on:—

Epson printers, Joysticks, Software by; Imagineering.
ECP, Ozisoft, Edusoft, Microsoft, and more

Diskette storage boxes from **$25.95**

Diskette doublers from an incredible low **$9.95**

TCA brand DSDD diskettes pack of ten yours for **$34.95**

Blank computer tapes from an amazing 50 cents each.
Minimum purchase of 4

Bring in or send in this note

— get 10% off our suggested prices for your purchase of $100 or more

** photocopy or duplicates not accepted (all on $10 rate) valid till 31st March*

Authorised Apple Dealer

Don't Miss Out

for grading itself. The length of the recall should be altered to reflect the stability of the environment. For example, in controlling a machine, the recall could be arbitrarily long, whereas in the more dynamic area of politics, the recall would be no longer than six or twelve months. The error-cost matrix can be used to good effect in dynamic environments, weighting the error-cost by the age of the symbol in error, thus expressing that old errors are less important than recent errors.

Interesting heuristics can be built into the evolutionary method. For example, to control the distribution across the modes of mutation. If a machine has consistently failed to attain an increased score, it may well be time to increase the complexity by adding another state. On the other hand, the size of the machine should be controlled against massive growth by synthesising an error-cost per state. Thus if a new generation can achieve a higher score, but only by doubling the number of states, that generation could be heuristically rejected. Finally, you can even introduce the concept of lateral thinking. If scores are failing to improve, the system could store its current machine (just in case), and start using a new machine with a very low score, in the hope that the new approach may lead to better results.

For added complexity, the new generation need not simply be the machine with the best score, but can be a combination of the last N 'best' machines. Dare we call it a 'heritage'? Mathematical proof exists which shows that any number of separate machines can be combined into a 'majority logic' machine which guarantees a better score. Figure four illustrates the use of this.

Results

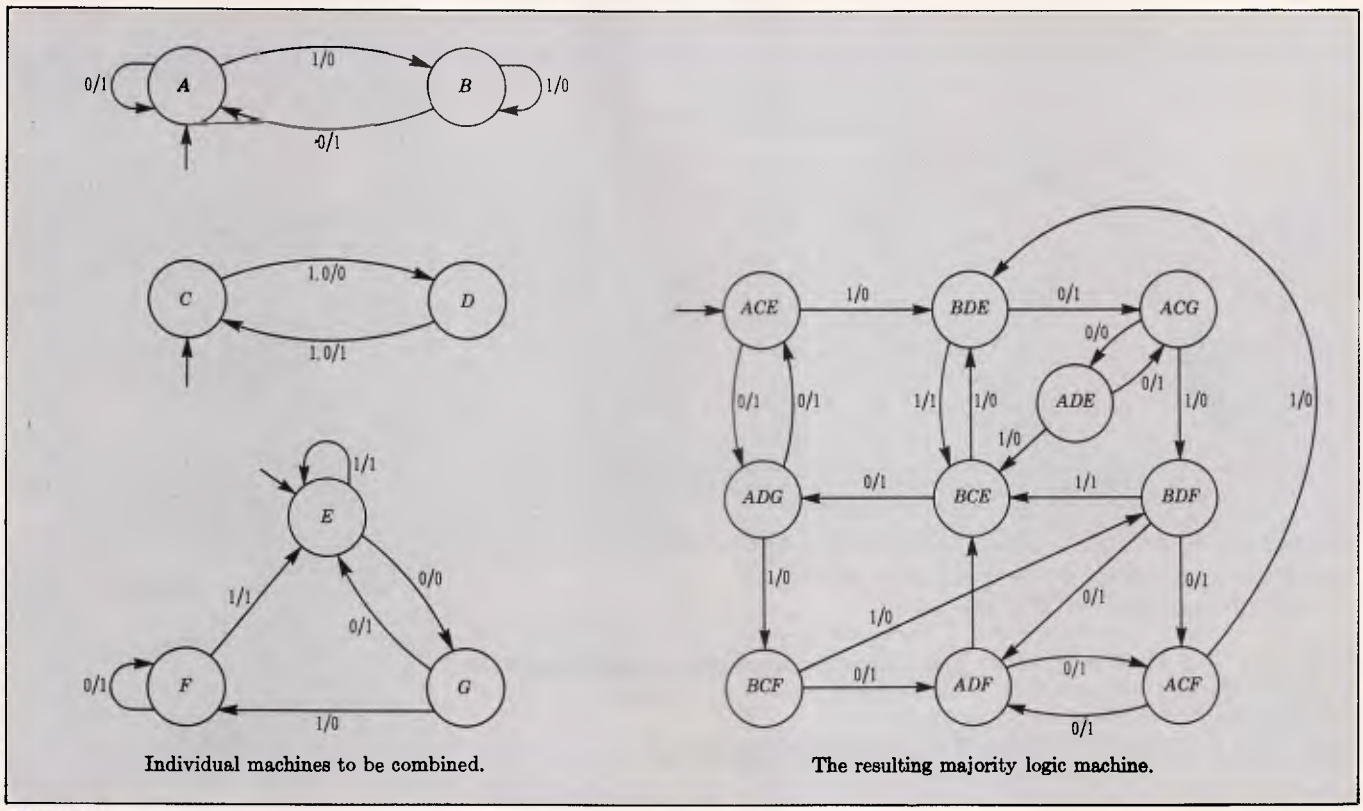
Fogel, Owens and Walsh did their original work on an IBM 7094 computer using FORTRAN, a machine less powerful than modern personal computers.

Their initial experiments used a cyclical input environment consisting entirely of the symbols '0' and '1'. Figure 5 shows some of their results as a percentage correct against the number of input symbols experienced. Notice how the system follows a traditional learning curve, with rapid progress at the outset. Figure 6 shows how the human designers of the system have no control over (and possibly no interest in) the final solution, as it diagrams three functionally equivalent eight state machines which were generated in the experiment.

Other experiments used patterns which suddenly reversed, or patterns filtered through randomisers, and all achieved statistically significant results.

One of the most impressive experiments was in prime numbers, which are generally considered to be randomly distributed, that it, there is no known formula which can be used to calculate a prime number, just iterative algorithms. Due to the limitations of their bi-symbol machine, the sequence 1, 2, 3, 4, 5, 6 etc was represented as a sequence of '1' and '0', where '0' indicated 'not a prime' and '1' indicated primeness. For example, '01101010001' stood for the fact that out of the first eleven integers, 2, 3, 5, 7 and 11 are prime. Using an unweighted error-cost matrix, the system was scoring 81.9% correct after 719 symbols, having risen above 78% after only 115 symbols.

By weighting the error-cost matrix to indicate that it was a more serious error to miss a prime, rather than call a false alarm, the results were drastically altered. Of the first 150 symbols, only five prime numbers were missed, from 150 up to 547, not a single prime number was missed. In each bracket, about fifty per cent were false alarms. Statis-



Individual machines to be combined.

The resulting majority logic machine.

Figure 4

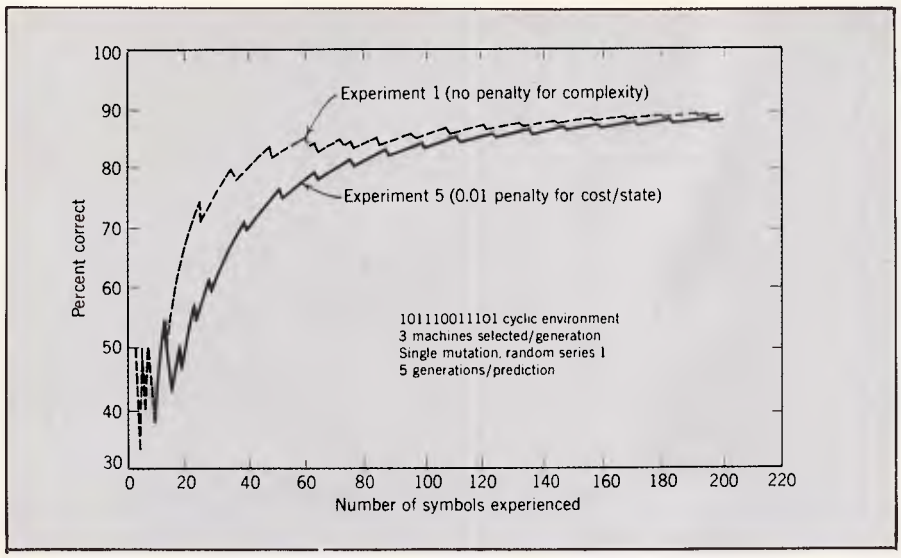


Figure 5: A comparison of the prediction score with and without a penalty for complexity.

tically, this is a significant result. The important point, is that nowhere in the program was there a definition of 'primeness'. Indeed, the program they used to predict prime numbers was exactly the same one used to predict simple cyclical patterns.

Again, using exactly the same initial machine, they applied the technique to some experiments which had been done on university students. The students were asked to predict a sequence of 1000 binary symbols. There were six different sequences, each of which followed some complex pattern rules but with random 'noise' superimposed on them. Figure seven shows the results attained by the students versus that attained by evolutionary programming. The 'ideal' score is that which could be achieved if one was told exactly how the pattern was constructed. The '10 symbol recall' is the score achieved by evolutionary programming when the 'recall' was set to only ten symbols, in other words, the program was allowed only to remember the last ten symbols.

Fogel, Owens and Walsh also went on to build an eight symbol simulator, which they applied to wave pattern recognition and classification, with some success. They saw automated plant control as one of the main applications for evolutionary programming. They envisaged the need for a plant to perform in a particular manner, as controlled through a number of parameters and measured through various sensors, but to do it even in spite of the essential dynamics of the plant and any internal or external disturbances which might occur. As is the philosophy of evolutionary programming, the goals are expressed by the error-cost matrix, and the method by which those goals are achieved is unknown, uncontrollable and irrelevant.

Conclusions

Fogel, Owens and Walsh saw evolutionary programming as an accurate model of the real world, since all actions are controlled by motivations or goals. They even saw parallels between the scientific method and the process of evolution in that scientists start with an assumption, attempt to prove the assumption, then alter the assumption, (if necessary) and repeat the process until the model is complete.

They stated that the catch phrase "the computer never knows more than the programmer" simply does not have to be true — and that *must* imply a simulation of true intelligence, as it means that the computer may be capable of solving a problem a human is not.

Their evolutionary techniques are a closer simulation of intelligence than any other software in existence. That is quite a grand statement, so let's list the tasks other approaches have been able to address, if not conquer:

- Query a database using natural English
- Be an expert in a specialist field
- Recognise fingerprints, faces or signatures
- Read printed text in a spoken voice
- Recognise slowly spoken words
- Hold a simulated conversation
- Direct a robot around a room
- Follow English commands to manipulate a controlled environment and explain it's actions

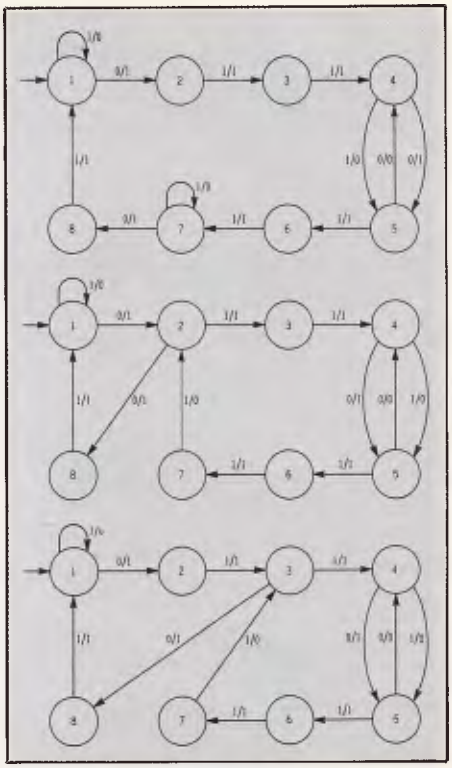


Figure 6: Three different eight-state machines which perfectly predict a 101110011101 cyclic environment.

Initial Sequence	Designation of Environment	Number of Subjects	Ideal Score	Evolutionary Score (with Growth)	Subjects' Average Score	Evolutionary Score (10-Symbol Recall)
521212 . . .	TR-1	6	0.75	0.730	0.690	0.639
523222 . . .	TR-3	6	0.75	0.720	0.695	0.630
4000524 . . .	TR-13	6	1.0	0.730	0.700	0.575
05050524 . . .	TR-U1A	5	0.875	0.865	0.830	0.725
130271 . . .	TR-U3	7	0.92	0.860	0.850	0.725
64125 . . .	WORD	24	0.934	0.845	0.760	0.540

Figure 7: A comparison of the predictive ability of the evolutionary program to that of human subjects (B. R. Wolin)

- Read a sentence and extrapolate based on predefined knowledge.

All of the above seems quite significant, but the point is that special techniques were invented and programs written for each of the above. There is no way you could take the program which understands sentences and teach it to be an expert system. However, they do all have practical uses.

The evolutionary approach, in contrast, can be taught to do anything. Its drawback is in the practical application. It, in some ways, can be considered as a 'pure intelligence'.

We feel intuitively that the evolutionary approach cannot be valid, as it seems to be an application of blind luck, however, bear in mind that it has taken two billion years to produce intelligent people — and two billion years is a long time. The evolutionary approach is the only system in AI which exhibits the hallmarks of true intelligence of its own (as against intelligence of its creators), and hence cannot be ignored.

Machine power has increased significantly since the original research work was undertaken, so there is yet much scope for the idea. Modern day enhancements could include an extended symbology — more than just two or eight symbols — perhaps the ASCII character set or a concept dictionary. Bear in mind, however, that as the symbol set increases, so does the processing time — exponentially.

The program

Listing one is a generic Basic program which illustrates one adaptation of the evolutionary approach. The program is much more rudimentary than those used by Rogel, and only loosely follows the original algorithm. Nevertheless, the program creates a finite state machine which is usually able to model its input, in such a way that you or I cannot predict, (and do not need to know), the logic by which the resulting machine operates.

The program uses a two symbol environment consisting of the characters '0' and '1', and uses the entire input as its 'recall'. Two machines are maintained, a 'current' and a 'best'. A variable is used to indicate which is which at any point in time. Mutations are applied in sets, the size of the set being determined by how far from a perfect score the current 'best' machine was, up to a maximum of five sets. This prevents it from making dramatic changes when it is close to the answer, and speeds up the initial iterations. The mutation mode is selected randomly in line number 1280, which generates a value from 0 to 19. By categorising these numbers, a probability distribution across the various mutation types is achieved.

The program continues to run until either a perfect machine is developed, or until a key is pressed. Upon termination, it displays the original input sequence as well as the model of that input produced by its best machine, which it extrapolates half as far again into the future. Throughout the run, a message is displayed whenever a 'better' machine is generated, even if that machine is only 'as good as' the current 'best' machine.

The program runs quite slowly, partially because Basic is not the best language for this type of work, and partially because most readers will be running uncompiled Basic. It will take some time before producing results — if necessary leave it for a while. If you plan to pursue this approach further, it would probably be a good idea to move over to some compiled language with data structures.

Any readers who develop programs or produce significant results related to evolutionary programming are invited to write to the Editor.

```
100 '            Experiments in Evolutionary Programming
110 '
120 '         Assumes an environment composed of "0" and "1"
130 '             Allows machines of up to 50 states
140 '
150 DEFINT A-Z
160 DIM OUTPUT.SYMBOL [1,49,1]     ' first subscript is machine,
170 DIM NEXT.STATE    [1,49,1]     ' second is state, third is input symbol
180 DIM STARTING.STATE[1]          ' initial state for machine
190 DIM SCORE         [1]          ' score for that machine
200 DIM NUMBER.STATES [1]          ' number of states in the machine
210 DIM ENVIRONMENT   [40]         ' stores the environment string
220 SCORE [0] = -1                 ' ensure first machine 1 will be best
230 ENVIR.SIZE = 0                 ' zero size until read
240 GENERATION = 1
250 RANDOMIZE TIMER
260 GOSUB 540                      ' fill the initial machine
270 GOSUB 690                      ' prompt for the environment
280 '
290 ' now start the evolution process
300 '
310 GOSUB 860                      ' score current.machine
320 IF SCORE[CURRENT.MACHINE] >= SCORE[BEST.MACHINE] THEN GOSUB 1010
330 IF (LAST.SCORE = ENVIR.SIZE) OR (INKEY$ <> "") THEN GOTO 350
340 GOSUB 1100                     ' mutate another current from best
345 GOTO 310
350 '
360 ' Perfect machine developed, or time to give up
370 '
380 PRINT "input: ";
390 FOR I = 1 TO ENVIR.SIZE
400     PRINT ENVIRONMENT[I];
410     NEXT I
420 PRINT
430 PRINT "model: ";
440 STATE      = STARTING.STATE[BEST.MACHINE]
450 PREDICTION= OUTPUT.SYMBOL[BEST.MACHINE,STATE,STATE MOD 2]
460 FOR I = 1 TO ENVIR.SIZE * 1.5
470   PRINT PREDICTION;
480   OLD.STATE = STATE
490   STATE      = NEXT.STATE    [BEST.MACHINE,OLD.STATE, PREDICTION]
500   PREDICTION = OUTPUT.SYMBOL [BEST.MACHINE,OLD.STATE, PREDICTION]
510   NEXT I
520 PRINT
530 END
540 '
550 '            create machine 1 randomly
560 '
570 BEST.MACHINE      = 0
580 CURRENT.MACHINE   = 1
590 NUMBER.STATES [1] = 2
600 FOR I = 0 TO 1
610     FOR J = 0 TO 1
620             OUTPUT.SYMBOL[1,I,J] = INT(RND*2)
630             NEXT.STATE   [1,I,J] = INT(RND*2)
640             NEXT J
650     NEXT I
660 STARTING.STATE[1] = INT(RND*2)
670 GOSUB 860
680 RETURN
690 '
700 ' prompt for the environment
710 '
720 PRINT "Enter the environment string as a series of single digits 0..1,"
730 PRINT "Use blanks to seperate digits for readability."
740 PRINT "Maximum length is 40 digits"
750 PRINT
760 INPUT ENVIR$
770 I = 1
780 WHILE I <= LEN(ENVIR$)
790       C$ = MID$(ENVIR$,I,1)
800       IF C$ = " " THEN GOTO 830
810       ENVIR.SIZE = ENVIR.SIZE + 1
820       ENVIRONMENT[ENVIR.SIZE] = VAL(C$)
830       I = I + 1
```

```
840       WEND
850 RETURN
860 '
870 ' Calculate score of current machine
880 '
890 STATE      = STARTING.STATE[CURRENT.MACHINE]
900 PREDICTION= OUTPUT.SYMBOL[CURRENT.MACHINE,STATE,STATE MOD 2]
910 INPUT.SEQ = 1
920 SCORE[CURRENT.MACHINE]  = 0
930 WHILE INPUT.SEQ <= ENVIR.SIZE
940   IF PREDICTION= ENVIRONMENT[INPUT.SEQ] THEN
                     SCORE[CURRENT.MACHINE] = SCORE[CURRENT.MACHINE]+1
950   OLD.STATE = STATE
960   STATE       = NEXT.STATE    [CURRENT.MACHINE,OLD.STATE, PREDICTION]
970   PREDICTION = OUTPUT.SYMBOL [CURRENT.MACHINE,OLD.STATE, PREDICTION]
980   INPUT.SEQ   = INPUT.SEQ + 1
990   WEND
995 LAST.SCORE = SCORE[CURRENT.MACHINE]
1000 RETURN
1010 '
1020 ' current.machine is better than best.machine
1030 '
1040 PRINT "At Generation "; GENERATION; " score is "; SCORE[CURRENT.MACHINE];
1050 PRINT " out of "; ENVIR.SIZE;"      size=";NUMBER.STATES[CURRENT.MACHINE]
1060 TEMP = BEST.MACHINE
1070 BEST.MACHINE = CURRENT.MACHINE
1080 CURRENT.MACHINE = TEMP
1090 RETURN
1100 '
1110 ' mutate a current machine from best machine
1120 '
1130 GENERATION = GENERATION + 1
1140 FOR I = 0 TO NUMBER.STATES[BEST.MACHINE]
1150  FOR J = 0 TO 1
1160     OUTPUT.SYMBOL[CURRENT.MACHINE,I,J] = OUTPUT.SYMBOL[BEST.MACHINE,I,J]
1170     NEXT.STATE   [CURRENT.MACHINE,I,J] = NEXT.STATE [BEST.MACHINE,I,J]
1180     NEXT J
1190  NEXT I
1200 NUMBER.STATES[CURRENT.MACHINE] = NUMBER.STATES[BEST.MACHINE]
1210 STARTING.STATE[CURRENT.MACHINE]= STARTING.STATE[BEST.MACHINE]
1220 ' have copied - now mutate
1230 NUMBER.MUTATIONS = ENVIR.SIZE - SCORE[BEST.MACHINE]
1240 IF NUMBER.MUTATIONS > 5 THEN NUMBER.MUTATIONS = 5
1250 FOR K = 1 TO NUMBER.MUTATIONS
1260 C=CURRENT.MACHINE
1270 LIM = NUMBER.STATES[C]
1280 MUTATE.MODE = INT(RND*20)
1290 IF MUTATE.MODE = 0 THEN STARTING.STATE[C] = INT(RND*LIM)
1300 IF (MUTATE.MODE > 0) AND (MUTATE.MODE < 9) THEN
       OUTPUT.SYMBOL[C,INT(RND*LIM),INT(RND*2)] = INT(RND*2)
1310 IF (MUTATE.MODE > 8) AND (MUTATE.MODE < 18) THEN
       NEXT.STATE[C,INT(RND*LIM),INT(RND*2)] = INT(RND*LIM)
1320 IF MUTATE.MODE = 18 THEN NUMBER.STATES[C] = NUMBER.STATES[C]+1
1330 IF (MUTATE.MODE <> 19) OR (NUMBER.STATES[C]=1) THEN GOTO 1410
1340 ' else delete one state
1350 NUMBER.STATES[C] = LIM - 1
1360 FOR I = 0 TO LIM - 1
1370 FOR J = 0 TO 1
1380     IF NEXT.STATE[C,I,J] = LIM THEN NEXT.STATE[C,I,J]= INT(RND*(LIM-1))
1390     NEXT J
1400 NEXT I
1410 NEXT K
1420 RETURN
```

What do you call software that gets smarter as you use it?

Q&A™ is built around an intelligent assistant that's smart enough to learn from your experience.

So you can teach it to respond to your needs to a degree no other software can match.

You'll find that that capability is worth a lot to you.

No matter what you use it for. Stock market analysis. Inventory. Employee data. Tickler files. Phone logs. Mailing lists. Anywhere you need fast access to stored data.

CALL IT EASY TO BUY.

At $499, we believe Q&A offers more value per dollar than any other software product on the market.

But we haven't stopped there.

We've come up with a way for you to get some value out of whatever database or word processing package you're currently using.

CALL IT THE BEST DEAL IN MEMORY.

We have an inexpensive way for you to take advantage of Q&A's intelligence and upgrade your hardware at the same time.

For a limited time, we're offering a half-length 256K memory board with Q&A. It's worth $400 on the street, comes with a 12 month warranty, and when you buy Q&A, it's yours for just $99

If Q&A is beginning to sound like a good investment to you, a quick demo should convince you.

Go to your local Q&A dealer and ask for one.

For more information on Q & A and What Is analysis call International Solutions Pty. Ltd., P.O. Box 269, Broadway 2007. Phone: (02) 319 1488 Telex: AA25331

We think you'll be glad you did.

Call it a hunch.

HYPEC SUPER PC

DUAL SPEED

$1950

Tax included
AT style case

MONITOR EXTRA

4.77Mhz and 7Mhz

- 2 x 360K control data disc drives
- 640K RAM
- Parallel port
- Serial port
- Games port
- Battery backed clock
- Choice of monochrome graphics or colour graphics card
- 6 months warranty
- 10 megabyte system **$2950 tax inc**
- 20 megabyte system **$3250 tax inc**

PC-88

THE SMALL PC
WITH THE

BIG FEATURES

$1850

Tax included

MONITOR EXTRA

- 2/3 the footprint of the PC
- 8 full length slots (6 free)
- 130 watt power supply
- ★ High quality Japanese boards
- 640 RAM standard
- 2 x 360K floppy disc drives
- Choice of colour graphic or monochrome graphics boards
- Includes multi function boards
- Optional dual speed function boards

10 megabyte system **$2750 tax inc**
20 megabyte system **$2990 tax inc**

PC-COMPATIBLES FROM $1250

High speed 20 megabyte tape backup

Full backup in 20 minutes • Quality TEAC mechamism
New powerful software

Internal system $1495 tax included

External system $1695 tax included

Chips

4164 Drams	$2.20 Tax inc
41256 Drams	$4.50 tax inc

Full range TTL in stock

Printers

NEC
Citoh
Riteman
Epson
Cannon
Brother
Silver Reed
Toshiba
Microline
KEL

Call for prices

Special

8" SS/DD discs
Never to be repeatd

Box 10 $20
Tax inc

QUBIE

Monitors
Disc drives
At computers
Multi function boards
Tape back up systems

Call for prices

POWER BACKUP

200 TO 5000 WATTS

200 WATTS FOR 5 MINUTES

$650 TAX INCLUDED

500 WATTS FOR 10 MINUTES

(AUSTRALIAN MADE) $1450

SERVICE

IBM-PC AND MOST COMPUTERS
IBM FIXED PRICE SERVICE

System board (PC/XT)	$110
Monochrome graphics board	$75
Colour graphics board	$75
5¼" disc drive adaptor	$50
Printer adaptor	$50
Async	$50

SWITCHING POWER SUPPLIES ALL TYPES SERVICED
$30 per hour + parts
Free quotes
120 day warranty

20 MBYTE TANDON DISC DRIVE

$960 — TAX INC

DISC STORAGE BOXES WITH KEY LOCK

$20
100 DISC SIZE

WIDE RANGE OF SWITCHING POWER SUPPLIES AVAILABLE FROM STOCK

SUPER AT

Monitor extra

6Mhz or 8Mhz systems available

20 megabyte system

- 1.2 megabyte floppy disc
- 640K RAM
- Parallel printer port
- Serial port
- Battery backed clock calendar
- 200 watt power supply
- 20 mbyte hard disc
- colour graphics or monochrome graphics
- Optional tape backup available
- Hard disc to 140 mbytes

$5100

Plus sales tax

Includes DOS 3.1

SOFTWARE

The Visible Computer Learn 8088 Assembler the easy way	$115
Peeks & Pokes Get more from your PC	$55
The Inside Track Power for your PC	$75
Framework II	$912
Lotus 123	$680
Symphony 1.1	$895
Clipper Compiler DBIII	$847
Microsoft Word	$490
Sidekick	$90
Microsoft Word + Mouse	$650
Easy	$220
D Base III	$755
Turbo Pascal	$98
Wordstar	$375
Wordstar 2000	$470

Software not listed call

TURBO ACCEL

THE 8MHZ 80286 TURBO CHARGER FOR IBM-PC & COMPATIBLES.

FANTASTIC PERFORMANCE FOR $1450 + *SALES TAX*

PHONE FOR BROCHURE

TURBO SLAVE

THE FASTEST Z-80 CO PROCESSOR :8MHZ Z-80H : RUN OVER 2000 CPM PROGRAMMES :TRUE MULTI-USER WITH TURBODOS **$800** + *SALES TAX*

A.T. BOARDS

- PC-AT COMPATIBLE MOTHER BOARD NO RAM **$1225.38**

EXPAND TO 1 MEGABYTE ONBOARD

- CASE $179.30
- POWER SUPPLY AT 200 WATT $290.00
- FDD: HDD CONTROLLER $647.00
- 2.5 MEGABYTEW MULTIFUNCTION (NO RAM) $344.49
- KEYBOARD $189.90
- RS232 & PRINTER CARD $179.80

PRICES DO NOT INCLUDE SALES TAX

ADD ON BOARDS FOR THE PC AND COMPATIBLES

DESCRIPTION	INCL. TAX	LESS TAX
MULTIFUNCTION CARD VER I	231 52	199 37
256K MULTIFUNCTION FOR VER II	277 03	238 56
STACK CARD FOR VER II MULITFUNCTION CARD	149 62	128 84
384k MULTIFUNCTION CARD –	SERIAL PORT	277 03	238 56
COLOUR GRAPHICS/MONO CARD	28ь 14	24ь 40
MONOCHROME CARD	186 02	160 19
MONOCHROME GRAPHIC CARD	24ь 69	212 43
FDD CARD	125 35	107 94
GAME ADAPTOR	76 82	66 15
MINI SIZE FDD CARD	131 42	113 17
MULTIDISK CARD	413 54	356 11
HARD DISK CONTROLLER	519 72	447 54
HARD DISK CONTROLLER V II	459 04	395 29
HARD DISK CONTROLLER V III DRIVE 2 INT FDD	489 39	421 42
256K RAM CARD	131 42	113 17
384K OPTION CARD	76 82	66 15
384K RAM CARD W/EXTRA PARALLEL PRINTER PORT	186 02	160 19
512K RAM CARD	125 35	107 94
I/O PLUS II 4 WAY	225 35	194 14
MULTI I/O CARD	319 50	275 13
ASYNCHRONOUS COMMUNICATION ADAPTOR	125 35	107 94
PARALLEL PRINTER CARD	82 88	71 37
FIRMWARE CARD	70 74	60 92
BUFFER PRINTER CARD	216 36	186 31
AD DA card	240 63	207 21
PC SUPER MODEM	352 88	303 87
PC BUS CARD	152 65	131 45
L TYPE MAINBOARD	311 40	268 15
SUPER MAINBOARD COMPLETE WITH 256K	533 34	459 27
SUPER MAINBOARD (OK)	425 00	367 00
SUPER TURBO MAINBOARD (DK)	425 00	367 00
COLOR/GRAPHIC PRINTER CARD	277 03	238 56
MONOCHROME COLOR CARD	474 21	408 36
DIAMOND I/O CARD	277 03	238 56
512K MULTI I/O CARD	398 38	343 05
576K RAM CARD	164 78	141 90
RS COMMUNICATION CARD	201 19	173 27
8255 I/O CARD	170 85	147 13
SUPER AD/DA CARD	398 38	343 05
NETWORK ADAPTOR	459 04	395 29
EPROM BURNER	292 20	251 62
TELEX CARD	398 38	343 05
EMPTY CASE	129 38	111 41
EMPTY CASE	129 38	111 41
IBM PC & PC/AT KEYBOARD	351 32	302 53
IBM PC KEYBOARD	260 31	224 16
IBM PC KEYBOARD	199 63	171 91
KEYBOARD	205 21	176 71
APPLE II PC KEYBOARD	260 31	224 16
APPLE II PC KEYBOARD	263 38	226 77
PC CLONE POWER SUPPLY SWITCH ON BACK	185 00	160 00
IBM POWER SUPPLY SWITCH ON SIDE	225 00	195 00

PHONE FOR CATALOGUE AND PRICE LIST

MONITORS

TVM 14" COLOUR/GREEN/AMBER SWITCHABLE **$750**

TAXAN $

VISION III $

VISION IV $

HIGH RES SET $

KIF 3800 PLUS $

VISION IV $

THOMPSON

BOOKS

DOS PROGRAMMING

BASIC,

ETC

ETC,

WIDE RANGE TO CHOOSE FROM

CALL . . .

HYPEC ELECTRONICS PTY. LTD.

HYPEC

Phone orders only (02) 808-3596

P.O. BOX 438 RYDE
SYDNEY, N.S.W. 2112
AUSTRALIA

TEL: (02) 808-3050
CABLE: "LAMRON" SYDNEY
TELEX: AA71551 LAMRON

Innovation '86

Ever thought that a PC needed something it didn't have? Ever wished that an IBM had an IEEE output, or that your Olivetti could understand every word you said?

Now, *APC* and Dick Smith Electronics are offering big prizes for big ideas, however small the start. And, alongside the big prizes, there is the chance to see your name in lights as the designer of an innovative product.

The winner of Class 1 will be awarded the first prize of a fully-blown Olivetti M24 system.

Prizes for winners in Class II and III will receive a Data Products Printer and $500 worth of software respectively. The whole object of the competition is to dredge the Australian PC fraternity for good ideas from which products can be made; so finalists in *each* category will have the opportunity of discussing their idea or product with an Australian development company, if they chose. Even if an idea isn't the winner, it may still become *a* winner in a commercial sense making profits for its originator.

Class 1 — Ready to Run

The top awards will go to ideas that have been pushed the closest to reality. Entries will be judged on a combination of innovation and production feasibility, and the idea presented should be as close to a working example as possible.

Comprehensive documentation and diagrams are expected as standard, and working examples, whether in breadboard or prototype form, would be an added bonus.

The winner in Class 1 will receive Olivetti's PC-compatible M24, equipped with a 20Mb hard disk. The M24 is known as one of the best, if not *the* best PC-compatible on the market. It boasts superb engineering, an ultra-fast processor and a display screen with resolution equal to Apple's Macintosh; and, of course, there's the security a big-name manufacturer in Olivetti and Australia-wide support through Dick Smith Electronics.

HOW TO ENTER: Submit your entry to Innovation '86, C/- Australian Personal Computer, 2nd floor, 215 Clarence Street, Sydney, NSW 2000.

ENTRY FORM

THE DICK SMITH ELECTRONICS/AUSTRALIAN PERSONAL COMPUTER INNOVATION '86

COMPETITION ENTRY

ENTRANT'S NAME.....

ADDRESS .....

.....

.....

TELEPHONE.....

I want to enter my idea into the:

CLASS I READY TO RUN ( )
CLASS II A GREAT IDEA ( )
CLASS III ACADEMIC ENTRY ( )

IDEA DESCRIPTION:

.....

.....

FURTHER DETAILS PROVIDED BY:

ITEM 1
ITEM 2
ITEM 3
ITEM 4
ITEM 5
ITEM 6

PLEASE MARK ALL ITEMS CLEARLY WITH YOUR ENTRANT NAME AND ITEM NUMBER.

To the best of my knowledge and belief, the idea/product described above is not in production anywhere in the world.

Signed .... Date .....
The Entrant

Failure to sign excludes entry from the competition.

Pictured above is the Olivetti M24 with a dual floppy disk drive. The lucky first prize winner will actually receive an Olivetti M24 with a 20Mbyte hard disk system valued at $6795 from Olivetti.

The winner in this class will receive a Data Products 8012 dot matrix printer from Dick Smith Electronics. The printer is valued at $995.

Class II — A Great Idea

Entries in this class will be judged on sheer innovation. Presentation of the idea need not be of the highest standard, and there do not need to be any prototypes or breadboards.

But the projected product must be feasible, and the idea must show some signs, however slight, of possible practical implementation. We would like to upgrade our PCs to 640k for $12.50, but unless you can demonstrate a product that can do it at that price, the idea alone is not good enough.

The winner in this class will receive a Data Products 8012 dot matrix printer from Dick Smith Electronics. The printer is valued at $995, and has three operating modes: draft mode (180 cps), medium (80 cps) and Near Letter Quality (30 cps). The printer will support standard IBM PC and compatible business applications including graphics and spreadsheets.

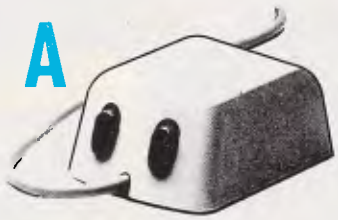
Class III — The Academic Team Prize

Here is where a team can enter. The winning project from a school, college or university, along the lines already described, will win a choice of $500 worth of software from Imagineering, Australia's leading microcomputer software distributor.

The Rules

1) The competition is open to anyone, except as detailed in Rule 5, as an individual. In the case of minors under 18, all competition entries and communication with the competition organisers must be through a legally-recognised parent or guardian.
2) Competition entries can be submitted in any form whatsoever, bearing in mind the objectives of the competition.
3) A competitor may enter as many different ideas as he or she desires.
4) Entries will close on March 31, 1986, with the winners to be announced in the May issue of *APC*.
5) Employees of Computer Publications or Dick Smith Electronics, and their principals and agents, are barred from competing.
6) The judges' decision is final, and no correspondence with the judging panel is permitted other than the submission of the entry.
7) Ideas and products currently in production anywhere in the world will be excluded from the competition.

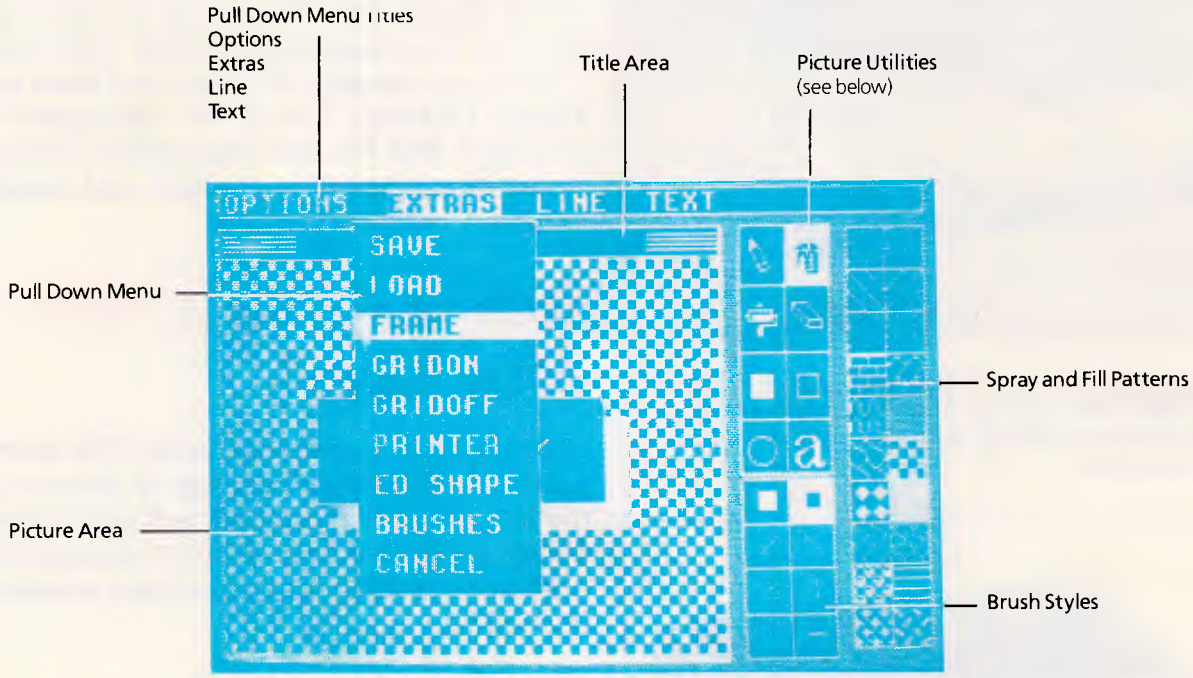
FOR COMMODORE C64 STUNNING GRAPHICS AT A TOUCH . . .



WITH THE DATEX OPTICAL MOUSE MS.I

- **FRIENDLY** — with pull down menus & icons!
- **HI RES** — works in bit mode
- Disc & tape software included
- Dump designs to printer, disc or tape
- Very high quality optical circuits
- Integrates with other forthcoming packages!
- ‚Mac'-like screen and features.
  Epson compatible

ONLY $159.95 RRP



To order: send cheques, MO's etc. to:

THE BIT SHOP
P.O. BOX 28, EARLWOOD 2206
OR CALL (799-8525) FOR MORE INFORMATION

WIN A DATEX MOUSE

Entries should be received no later than February 21, and prizes will go to the first three correct entries pulled out of the editorial hat.

Send your entries to:

Australian Personal Computer
2nd Floor
215 Clarence Street
Sydney NSW 2000

Name _____

Address _____

_____ _____ Postcode _____

1. Which computer was the first to feature a mouse?

_____

2. Which company distributes the Datex Mouse?

_____

_____

SCREENTEST

Reflex

Reflex is an attempt to fill the gap between elaborate spreadsheet packages and the less closely integrated but more powerful database suites. Kathy Lang compares its value for money with its capabilities.

Among the figures which I prepare for inclusion in each of this series of reviews is a table comparing the current offering with several reasonably similar products reviewed previously. This was a harder task with this month's package, Reflex, than with any other system I've looked at. For Reflex is a very rare animal among current products, but it may be the first to address a very real problem, namely that many people need to process information in ways which borrow from the techniques of both spreadsheets and data management systems. Some of you will no doubt feel that this is just the area addressed by the integrated packages, but on the whole I would disagree. Symphony *et al* are fundamentally spreadsheet packages with some data management features tacked on, while the less closely integrated suites, such as Smart and Open Access, provide greater power in individual modules at the expense of close integration. Reflex is trying to fill the gap inbetween these two approaches, and at a very competitive, not to say ridiculous, price of $249.

One way to describe Reflex would be to call it a combination spreadsheet, data management and graphics package, and that does indeed convey some of the flavour of the package, but it is more than that. Reflex allows you to look at your data in five different ways, which it calls Views: Form (one record per screen); List (one record per line); Graph; Crosstabs (a two-way summary table); and Report (powerful, but separate, reporting facilities). Up to three windows can be created at a time, allowing you to see form, list and graph representations at the same time. Like so many of the newer products, Reflex is used via pull-down menus (or commands, for the more practised), and/or a mouse.

Each Reflex database is essentially a table, with no interconnections between tables (although you can merge one into another). All the data you are currently processing must be held in memory at the time, but it is possible to filter data when reading from disk files, so you can have data files larger than memory can contain. (Files are updated correctly when the processed records are saved.)

However, the version I had did not support the extended memory provided by bank-switched boards such as Intel's Above-Board, but that can only be a matter of time. With Reflex as it stands, I was able to carry out the full Benchmark on a 512k system (1000 records of 152 characters each), something not always possible with memory-resident packages. Beyond that, it is hard to be specific about memory capacity, as the limits depend on what your data contains.

Integers take up little space, text and real numbers are by their nature more greedy, but Reflex helps by storing only what is actually present — fields are variable in length, and, indeed, it is not necessary for you to define their maximum length.

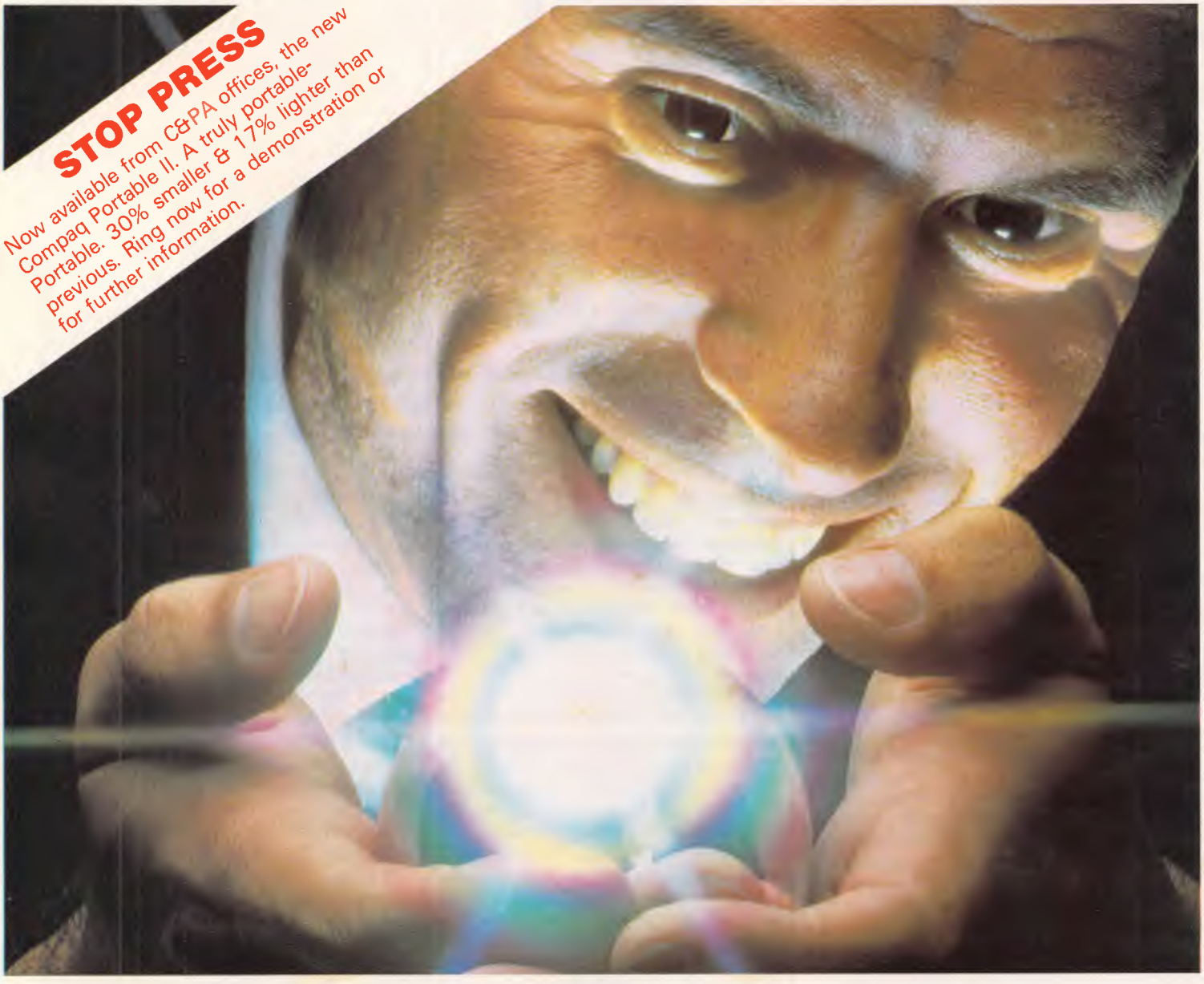
Reflex is an American product, designed by Analytica, which has recently been taken over by Borland, the manufacturer of Sidekick and Turbo Pascal. At its current price, you are unlikely to get much support — but then, it is extremely easy to pick up the basics, and the absence of tailoring features (such as macros) makes it less likely that you will need help later on.

Print settings

LIST view

Field and sort settings

We have the Compaq Idea"



C. & P.A. + Compaq = a bright Idea

Now you can get your compaq computers throughout Australia from C. & P.A., following a distribution and support agreement.

C. & P.A. was formed only nine months ago and is heading to top $15,000,000 in sales for fiscal 1985/86. Compaq has recognised the inherent strength of the C. & P.A. organisation which is one of the few Australian Distribution companies to provide its own complete maintenance and after sales facility.

C. & P.A. is developing a number of hardware and software packages for use in CAD and business applications, some developments are in conjunction with major users and resellers of computer solutions. Compaq is the second largest supplier in the world of personal computers for business application, and is the largest supplier of industry-compatible, full-function portable computers.

Communications & Peripherals Australia

VIC.: Telephone (03) 544 3444 W.A.: Telephone (09) 328 1533
N.S.W.: Telephone (02) 848 8533 QLD: Telephone (07) 352 5788
S.A.: Telephone (08) 46 4062 A.C.T.: Telephone (062) 80 4801

COMPAQ
SIMPLY WORKS BETTER

Constraints

The major constraint is, of course, the need to have in memory all information being processed.

If the package is viewed as a spreadsheet rather than as a database, then the structured nature of the format may seem like a restriction — you can only have one set of data in memory at a time, and there are formal ways to, say, total all the elements in one field. Nevertheless, the formality is kept to the minimum necessary to enforce a rectangular table, rather than the more amorphous structures which are possible in spreadsheets, but which can actually limit what you can do with them.

Fields types are limited to character, numeric, integer and date; dates are always entered in the American form, but can be displayed in several others — the nearest to the Australian convention is dd-mm-yy, for example 16 Nov 1985.

File creation & indexing

The minimum necessary to create a data set is to specify the names of the fields. Each column in the table of information then becomes a field, with each row being a record in data management terms.

Maximum field lengths are never defined: Reflex simply displays as much of the information in a field as it can, and scrolls through it within a field window if the content is wider than the displayed width.

Field type may be deduced from the data entered into it, much in the manner of some spreadsheets — for example, if the first character to be entered into a field in the first record is a number, Reflex assumes that the field is to be a real number. You can alter these settings, or specify them before entering any data, through one of the menus. This involves filling in a table which has in one column the field names, and in subsequent columns the field type, sort order, and so on.

Maximum file size	Memory limited
Max record size (ch)	32,512
Max no fields	128
Max field size	254
Max digits	15
Max prime key length	Not available
Special disk format?	No
File size fixed	No
Link to ASCII files?	Yes
Data types	Character, numeric (incl. decimal point), integer, date
Fixed rec structure?	Yes
Fixed record length stored?	No
Amend rec structure?	Yes
Link data files?	Not available
No data files open	5
No sort fields	Not available
No keys	Not available
Max key length (chars, fields)	Not available
Subsidiary indexes kept up-to-date	Not available
Data validation	Adequate
Screen formatting	Paint-a-screen, Default
Unique keys	Not available
Report formatting	Paint-a-screen
Store calculated data	On input (or updating in batch); while editing interactively; batch process to change specified fields/records
Totals & statistics	Yes
Store selecn criteria	Mandatory
Combining criteria	And,Or,Not
>1 criterion/field?	Yes
Wild code selection?	Yes
Browsing methods	Any field
Interaction methods	Menus, commands
Reference manual+	***
Tutorial guide+	****
Reference card+	No
Online help+	****

Note: Maximum five stars possible

Fig 1 Features and constraints

Reflex automatically provides a List format, in which each record is displayed on a single line, with sideways scrolling. In addition, you can set up a Form view of your own design, using paint-a-screen techniques, in which each record occupies the whole screen.

No conventional indexing facilities are provided, and indeed indexes are not really needed where all the information is held in memory anyway. Records can be sorted into any desired order, but sort order is not automatically maintained during editing.

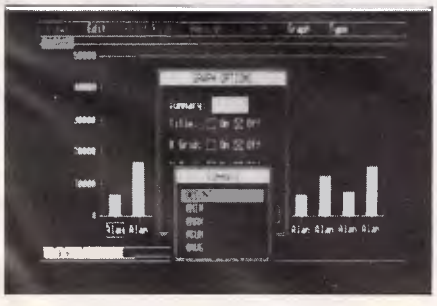
Data input & updating

Data can be added either in List or in Form view. The latter is convenient for just adding a few records, but for regular data entry you would want to use Form. This is, of course, an area where Reflex scores over the conventional spreadsheet, in that either approach can be used.

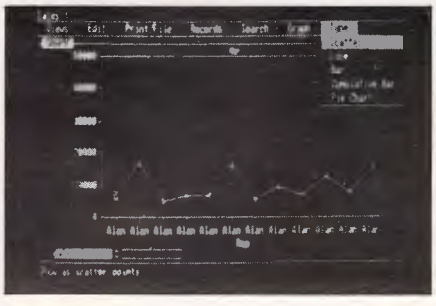
Records can be added anywhere in the table, so that you can maintain a particular record order manually if you wish. This is easier in List than Form, but you probably would not bother in practice since sorting is so fast. Any field can be made to take the same value as the equivalent field in the previous record, just by entering ditto marks into the field — a nice feature, cleverly echoing what people did before computers came to plague and please us.

An unusual feature of Reflex is its Vary command — you can use this to set up skeleton records which will be filled in later. This could be particularly useful either to provide test data to try out 'what if' calculations, or to enter information common to many records before filling in the variable data.

In addition to editing records and fields individually, you can also update the whole or part of the table at one go, using the extremely powerful calculation features, either on the whole table or a subset defined through the selection facilities.



Graph options



A scatter graph

A bar graph

NEW SOFTWARE TO HELP YOU RUN YOUR BUSINESS . . .

Lewis CROSS-CHEQUE

TRACK YOUR INCOME & EXPENDITURE

- ★ Improve your financial control by getting reports about your business at the press of a button.
- ★ Reduce your time spent on preparing your accounts and income tax return.
- ★ Replace your cash book.
- ★ Multiple cheque accounts.
- ★ Price is $240.00.

CROSS-CHEQUE IS IDEAL FOR

organisations unsuited to general ledger accounting such as

Doctors	Family Businesses
Shops	Personal Accounts
Farms	Service Industries
Dentists	Motor Industry

CROSS-CHEQUE follows the success of the CASEG medical accounting system and

Lewis PAY-PACK

PAYROLL SYSTEM

- ★ Used by over 100 Australian business in over 30 industries.
- ★ Includes management of sick and holiday leave.
- ★ Price is $690.00.

EASY-TO-USE

Both programs are designed to be used by people with no computer training. At all times, 3 lines of the screen are devoted toinstructions of what to do next.

DEMONSTRATION DISKETTES

and manuals are available for PAY-PACK ($50.00) and CROSS-CHEQUE ($30.00). This cost can be credited to purchase price. Both programs are available for MS/DOS and CP/M80.

Contact Dr Geoffrey LEWIS
Custom-Made Software Pty Ltd
PO Box 507 Randwick 2031
Tel (02) 399-8520

MELBOURNE'S NEWEST COMPUTER SHOP ANNOUNCES ITS OPENING SALE

For PC & Compatible users . . .

H/DUTY printer cables	$25
ANTISTATIC dust covers	$14
JOYSTICKS	$25
3 WAY printer switches	$58
TRANSNET network boards	$575
512K RAM boards (0 ram)	$125
M/FUNCTION boards	CALL
COLOUR/GRAPHIC boards	CALL
TTL monochrome boards	CALL
F/DISK CONTROLLERS	$99
20MB Hard disk drive — with controller	$1295
KEYBOARD OVERLAYS — all popular software	$15
CITOH 40 cps 15in D/WHEEL — with tractor feed	$2395
MICROLINE 84P PRINTER — 200 cps 15 inch	$1395
RITEMAN 15 PRINTER — 160 cps 15 inch	$999
RITEMAN BLUE PRINTER — 140 cps 9 inch	$499
TAXAN Super Vision 4 — RGB at its best	$950

For NON-PC users . . .

ICL Terminal	$975
PULSAR L.B.B. & 2x8 in DD/DS drvs mounted together — As traded with guar	$1495
PULSAR L.B.B. board complete NEW — built by PULSAR	$425
Twin 8 in DS/DD drives in case with 240V P/S	$695

Ring NOW with your BANKCARD or VISA details to secure these bargains . . .

HAWTHORN COMPUTER CENTRE
316 Auburn Road
Hawthorn 3122
(03) 818 2208 — (03) 819 4214

SYSTEMATE

FEATURES AND SPECIFICATIONS

INTRODUCTION:

SysteMate spans the user spectrum from the first time diskette user through the most sophisticated user, who wants to employ multi-level security measures for the protection of valuable data and programs. For any user, SysteMate offers simplicity of use and flexibiilty. With SysteMate, there is no need to learn or remember DOS commands or complex interfaces with other software.

FEATURES:

Some of the SysteMate features include:

- Common Startup Procedures For Software: The particulars of DOS commands, subdirectory assignments, default directories, load commands, special parameters and other details are transparent to the SysteMate user.
- Unlimited Menu Nesting: The number of menus is limited only by the disk storage capacity of your system.
- Run-Time (Pre and Post) Execution Instructions: Enables you to have screen prompts defining exactly how to run an application and what to do when finished. Users, particularly diskette users, can establish standard operating procedures that can eliminate errors and reduce training and retraining requirements.
- User Definable Diskette Labels: You can create and check labels on diskettes prior to running. This eliminates costly mistakes and errors. Properly used, you will not accidently write over existing data or clobber important data.
- **SECURMATE** — A sophisticated comprehensive security management system including:
- Authorization Codes: Security codes can be used, so that only those individuals who know the authorization codes can alter system components. At the System Menu level, the authorization code becomes a master key to all the security codes used in the system. With knowledge of the System Authorization Code, one can substitute it for any other code or access credential. If you know the System Authorization Code, you can not be locked out of the system.
- User Access Codes: SysteMate can be set up so that at "sign on" a user number and a user code are required. If you utilize user codes, the user number is required but the user code is optional. If there are no user codes, users need to type only their user number to gain access.
- Passwords: Any menu item can be protected with its unique password. Thus, users have the ability to set up virtually any type of hierarchical password system, limited only by need and creativity.
- Passwords, User Access Codes and Authorization Codes are all retained in a DES encrypted form. Therefore, disk dumps, memory dumps, or debug displays will not reveal passwords or codes.
- Program/Subsystem Lock: Users cannot circumvent the security system by using their knowledge of DOS, because you can utilize the SysteMate security locks to prevent access through DOS.
- Encryption — is available if or where needed though. SecurMate provides comprehensive encryption technology including DES, a modified DES, and a proprietary high speed algorithm.
- Safety Deposit Boxes — an unique feature of SysteMate which allows users to lock programs or data on any drive, in any directory or subdirectory that would normally be accessible through DOS. The System allows up to 32000 system Safety Deposit Boxes and each user can have up to 32000 of their own private safety Deposit Boxes.
- Gate Locks — another unique feature of SysteMate allows you to put GATES, which can be locked, in the paths to programs and data so that they can not be accessed by DOS even if the data and programs behind the gates are unlocked.
- Block Root Directory/Block FAT — allows you to block the root directory so that additional entries cannot be made to directory and/or to block the FAT such that additional allocations can not be made.
- **SURMATE**, SysteMate Utilization Reporting, allows you to develop and print comprehensive reports for internal use or in compliance with IRS Contemporaneous Regulations. Reports can be selected from a predefined menu of standard reports or tailored from a menu driven report generator. Once tailored to your needs, you can save your report formats in a library for recall, eliminating unneccessary respecification. On the data set of User, Menu, Item/Application, Date and Time, you may SORT in any order, itemize or summarize, subtotal or total as needed! Report headings may also be tailored to fit most reports onto letter size paper.
- **DOSMATE** — a powerful DOS Macro processor allows you to execute either built-in or keyed DOS commands directly from SysteMate without having to exit to DOS. Effective replication of batch files, elimination of redundant input, in line operating instructions, actual runtime variable inputs and other features considerably expand your DOS capabilities.
- SysteMate is the answer for General Business Systems, Educational Systems, Government Systems, Financial Systems, Professional Systems, Engineering Systems.
- SysteMate is the answer for any user, who wants to cut through the peripheral details, access their applications directly, and spend their time productively.

Aardvark Utilities,
P.O. Box 133,
HAWTHORN, VIC, 3122,
(03) 819 1996.

Screen display

Reflex's five data views provide an unusual variety of ways to inspect information. The graphics facilities are good — up to the standard of many spreadsheet packages. You can plot data for the x-axis and up to eight y-axes; styles provided include line, scattergram, bar, cumulative bar and pie. Links between the various views are good; for example, if a particular graph point looks worth investigating, you can ask to see it 'blown up' in Form.

You can also see graphs of summaries — totals, counts, averages, and so on — and display these 'by each' value of another field, perhaps looking at the average sales of a product each month for a year. Graphs can be scaled, labelled, displayed with different checking patterns, and so on.

Printed reports

Within the main part of Reflex you can print screens, or you can print all or part of a table shown in List view, with control over page layout. Much more sophisticated features are provided through the separate Report program, which allows you to lay out reports easily but with considerable flexibility. Reports may be complete lists of many records including headings, detail lines, sub-total lines and summary information, or they may just be summary reports showing totals and averages. You can preview such a report on the screen to see how the first few records will look in your format, and edit it before printing the article.

Calculation

As you would expect from a package of this type, the calculation features are exceptionally good by data management standards. You can use calculation facilities on entry, during selection and in reports, and there is also a powerful recalculation feature. This can be left to Reflex to carry out automatically, in which case only fields affected by changes in the values of data items entered are recalculated, or you can opt to have recalculation carried out only on request. This saves time when entering data where lots of calculations must be carried out — you can trigger them all in one go at the end while you do something else.

Reflex has a plentiful range of functions, both mathematical functions such as ABS and RAND, and also financial functions such as present and future annuity values and loan repayment calculations. Data functions are also provided.

Selection & sorting

While working with records on the screen, in any view, you can select subsets of records in one of two ways. You start by setting up the selection criteria, and here Reflex is both flexible and easy to use. The simplest method is to fill in a table, in which you can enter a criterion for as many fields as you wish. Or you can enter a selection criterion on a single line — quicker, and more powerful, since you have more control over combinations of tests, but less easy for novices. Tests on numeric fields can employ the usual comparison operators (equal, less than, greater than, and so on), and also some shorthands. For example, Cost BTWN (150, 250) is equivalent to Cost>150 AND Cost<250.

Tests on character fields can also employ comparison operators, though not the shorthand forms, and in addition you can use wild codes to test for partial matches. Unlike most packages, Reflex uses two dots as the wild code symbol to avoid the problem of searching in strings which may contain the more commonly used asterisk symbol. Any tests may be combined with AND, OR and NOT, and in addition you can search for all records which do not meet a complete search, multi-test specification. Another unusual feature is the ability to test for variable values: for example, you can search for all records where the profit is less than 10 per cent of the selling price. This feature could be invaluable in many applications of the kind commonly processed through a spreadsheet.

Records may be sorted in order on up to five fields; as sorts are carried out entirely in memory they are extremely fast. Sort order is not automatically retained when records are added or amended.

Housekeeping

Reflex provides a limited range of housekeeping features, for example to delete or rename files, so most operations would be possible without having to exit to DOS.

Links with outside

An unusually powerful importing facility is provided with Reflex; it can read directly the internal file formats used by Lotus 1-2-3, Symphony, dBaseII, dBaseIII and PFS, as well as several ASCII text formats including DIF, delimited and fixed-length records.

Reflex also makes it relatively easy to carry out the importing; you can begin by giving it the name of the external file to import, and it will do its best to work out the format of the file. It does this by reading the first record of the file, and displaying a table showing field names, types, and so on, which you can then modify if necessary. For packages such as dBaseIII, which itself uses field names and types explicitly, Reflex will make the correct translations, although in the absence of a 'logical' data type these become character fields. Similarly, with 1-2-3, row and column labels are used as record and field identifiers.

With ASCII files, which contain only data, Reflex assumes that the values are field names and deduces the delimiters being used. In most cases, all that is then necessary is to edit the name fields to show correct field names, and modify data types for date or numeric fields. As a result, in addition to its basic capabilities, Reflex is being promoted as a means of

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	2secs
BM3	Time to select record by secondary key	NA
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	7secs
BM5	Time to access record using wild code	7secs
BM6	Time to index 1000 records on three-character field	NA
BM7	Time to sort 1000 records on five-character field	32secs
BM8	Time to calculate on one field per record and store result in record	9secs
BM9	Time to total three fields over 1000 records	23secs
BM10	Time to add one new field to each of 1000 records	MD

Time to import a file of 1000 records: 7mins 50secs

Notes: NT=Not tested. NP=Not Possible. +=including scrolling. Where two times are given, first is access to first record, second is access to each subsequent record

Fig 2 Benchmark times recorded on IBM PC/XT/H

providing detailed formatted reports from 1-2-3, at a similar price to Lotus's new Reportwriter add-on.

User image

Analytica has put quite a lot of thought into the way Reflex is used. Each major area has its own set of commands, with a menu heading shown on the top of the screen. Pressing the slash character puts you into command mode; you can then pull down the appropriate menu and move the highlighted bar onto the desired option, using cursor keys or a mouse. Once used to the system, you can instead press the slash key followed by the two-character abbreviation for the option, which consists of the first letter of the menu name followed by the first letter of the option. (So to retrieve a file containing existing data, you press slash, followed by P for the Print/File menu, followed by R for Retrieve file.) Where a menu option is not currently available, it is shown in faded type.

Once into a command area, there are some neat touches to help you. For example, a function key (F10) is used to display what Reflex calls Choices — this could be a list of current field names when setting up a detail line in a report, or, once a field has been specified, a list of the functions available to accompany it (SUM, AVERAGE, and so on).

When you move among the List, Form and Graph views, you can either show the new view in full-screen size, or split the screen horizontally or vertically to show the new view in a window. Windows can be resized, and you can zoom in and out of whole screen views.

All these features are really nice to use, with the exception of the mouse. I soon gave up on that, because every time I selected and then deselected an item, the display was not refreshed properly — Reflex left 'holes' where the mouse had been. (I know the moon was once thought to be made of cheese, but surely never a PC screen?) Nevertheless, I did find Reflex an easy package to get to grips with, despite its rather novel combination of features. This may be partly due to the onscreen Help, which is well-organised and clear, though very occasionally a little less context-sensitive than the ideal.

Documentation

Reflex comes with a perfect-bound manual of an intimidating thickness but of excellent quality, and with lots of screen examples, all using Reflex data files distributed with the system. This should be sufficient to get most people going, essential for a cheap package on which you are unlikely to receive any training without paying extra. My only real complaint about the manual is the sequencing. It is in several numbered parts; within each part the sections are also numbered, with the page-numbering continuous throughout each major part. On the contents pages, however, the sections within each part span several pages, with no indication of the part to which the sections belong Therefore, it is possible to see a subject under a sub-head '5' page 32, which actually refers to sub-head 5 within major part 3, and therefore has page number 3-32. If that explanation sounds confused, so was I after a few look-ups! The index is, however, pretty thorough and uses page numbers, so you can actually find things that way.

Reflex is distributed with a manual, and also a 'how to' book written by expert users, which was very interesting in terms of providing ideas about applications of this slightly unusual package.

My review copy did not have a function key template, but one is illustrated in the manual — the 10 PC function keys are used, plus shifted versions of a few of them, with no keyboard equivalents, so it does help to have a template.

Conclusion

Reflex is a powerful package considering its extremely low price, and neatly spans the borders of data management and spreadsheet-with-graphics. For people whose data will fit into the memory of a PC, it would be a good choice for applications which involve lots of numerical manipulation, but where the ability to easily design data entry forms and reports is also needed. The lack of any ability to associate sets of records dynamically, and the absence of macro or keyboard 'learn' features, limits it to straightforward data structures and rules out the needs of system developers.

But given those constraints, Reflex is excellent value for money. As memory capacity grows, it may become increasingly the choice of those who need both data management and spreadsheet tools. And what a price!

END

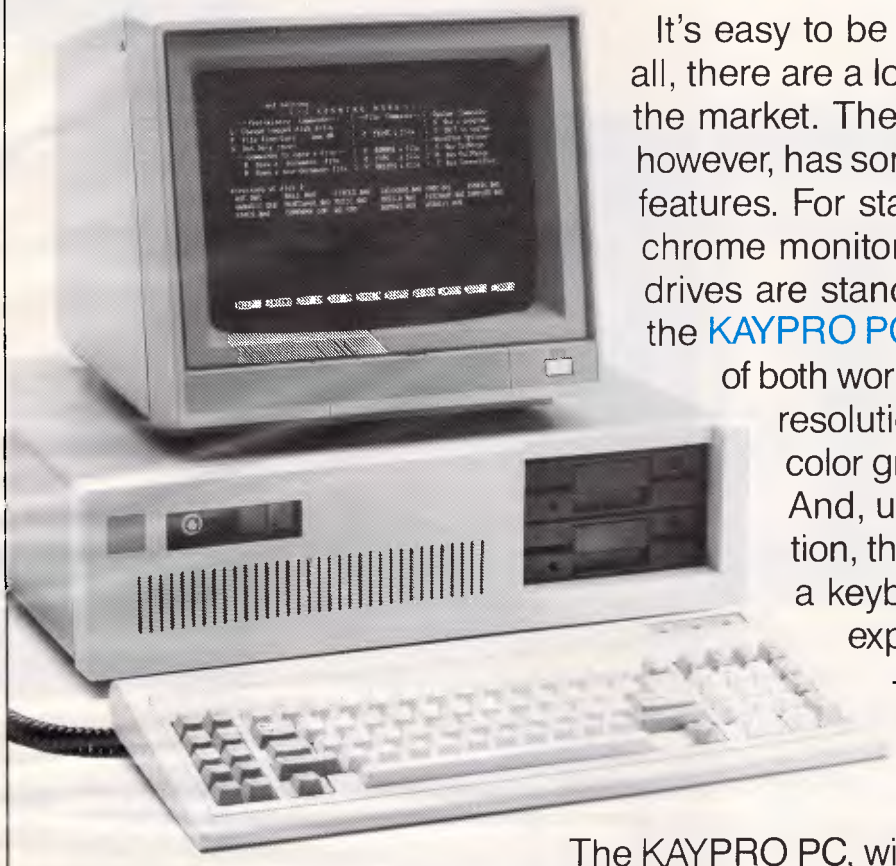
Package	Cost ($)	Summary
File	365	Data management system designed to make good use of special Mac features, so very visual approach. Provides good basic data management features for single-file, fixed-format records, stored as variable length. Links to Word, Chart and Multi-Plan.
Friday!	425	Simple, cheap, good-value package for single-file, fixed-format records. Drawbacks are clumsy approach in letter-writer and in designing screen formats. Excellent tutorial manual and menu charts, reference manual is good used from screen to manual.
Reflex	249	Hybrid data management/spreadsheet/business graphics. All data must reside in memory, but can filter larger database from disk — updates done correctly when file is saved. Very cheap, good importing, so could provide reporting for other spreadsheets.

Comparison of similar data management packages

Summary

Supplier:	Imagineering, Software Corp of Aust, ARCOM Pacific
Cost:	$249
System type:	PC; variable novice use
Features:	Good onscreen features, including five different views of the data, one of them Graph mode. Excellent calculation features. Good selection, including reselecting from subsets. Very powerful reporting, wide range of importing formats.
Drawbacks:	All information being processed must be in memory. No tailoring facilities. No text handling beyond selection
Ease of use:	Very good: used either through pull-down menus or commands, plus function keys. Can also use mouse.

Don't Be Fooled By Expensive Imitations



It's easy to be confused. After all, there are a lot of *beige* PCs on the market. The KAYPRO PC, however, has some very distinctive features. For starters, a monochrome monitor and *two* disk drives are standard. In addition, the KAYPRO PC boasts the best of both worlds – perfect high-resolution text and built-in color graphics capability. And, unlike the competition, the KAYPRO PC has a keyboard just like the expensive IBM PC AT – security lock and all.

The KAYPRO PC, with its 8088 CPU and 256KB RAM (expandable to 768KB) delivers 100% IBM PC or PC XT compatibility. It's got nine slots for easy expandability and service. Plus, every KAYPRO PC buyer gets a generous collection of quality business software, including WordStar, absolutely free. Finally, the KAYPRO PC is easily distinguished from the others by the sticker on the box that says "Made in the U.S.A." See the KAYPRO PC difference at your Kaypro dealer. You'll know that ***Kaypro Means Business*** – and business computers.

PRICE: $1995.*

KAYPRO®
CORPORATION

Innovators of Electronic Products for Over 33 Years

Trademarks: IBM, International Business Machines; WordStar, MicroPro International

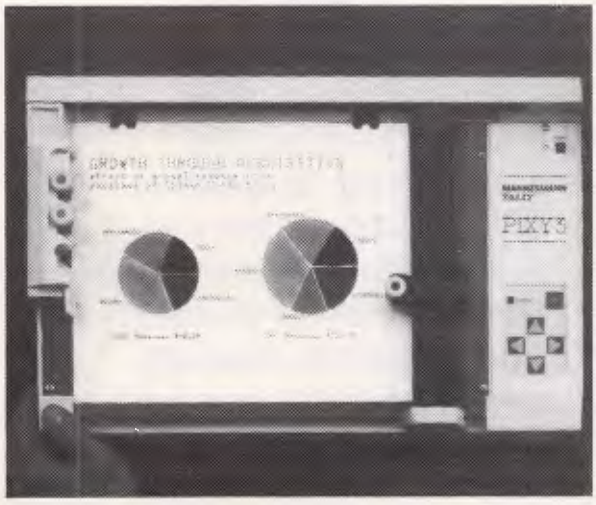
*Suggested Retail Price

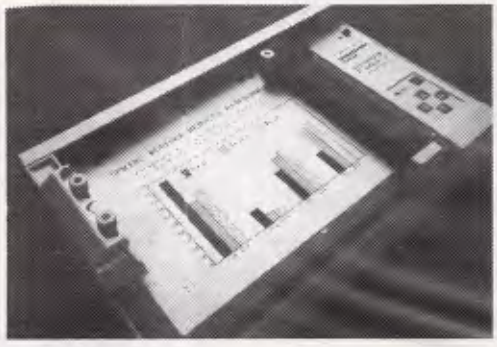
For more information on the Kaypro product line call: **(02) 542 3866**

See us at Booth #809

PROFESSIONAL PRESENTATION GRAPHICS WITH YOUR PERSONAL COMPUTER —

PIXY 3™





$395.00

inc. Tax

Freight Extra

Convert computer data into plots in seconds. Develop persuasive, accurate pie charts and bar graphs in minutes. Design with color knowing that the PIXY 3 Microplotter will change up to three pens automatically.

Created for speed, high resolution and ease of use, the PIXY outperforms everything else in its price range. In fact, you would have to spend up to twice the cost of a PIXY to equal its performance.

When you need artist quality, presentation graphics in a hurry, there's no comparison. The compact PIXY Microplotter delivers professional results for less.

PERFORMANCE THAT COMMANDS ATTENTION

THATS RIGHT

$395.00

inc. Tax

SPECIFICATIONS

Plotting Speed:
200 mm/sec (8 in/sec), programmable
Step Size:
0.1 mm (.004 in)
Plotting Area:
180x245 mm (7x9.7 in)
Media Size:
☐ 8.5x11 in (ANSI A size)
☐ 210x297 mm (DIN A4) size)
Repeatability:
Same pen — 0.3 mm (.012 in)
Pen to pen — 0.4 mm (.016 in)
Distance Accuracy:
± (1% travelled distance + 0.3 mm)

PENS

Type:
Fiber tip — water base for paper, oil base for transparency film
Colors:
black, red, blue, green, brown, orange, rose.

CHARACTER SET

Basic:
96 characters ANSI or other (specified by font command)
Extended:
☐ 37 Greek characters
☐ 9 international character sets

INTERFACES
☐ 8-bit parallel or
☐ RS-232 C

POWER REQUIREMENTS

Voltage:
☐ 220 V or 240 VAC ± 10%
Frequency: 48 to 62 Hz
Consumption: 40 VA maximum

ENVIRONMENTAL REQUIREMENTS

Temperature:
5 to 35°C (41 to 95°F)
Relative Humidity: 35 to 75%

INDICATORS
☐ Power On
☐ Error

OPERATING MODES
☐ Plotter
☐ Printer
☐ Diagnostic

DIMENSIONS AND WEIGHT

Height: 12.3 cm (4.9 in)
Width: 43.0 cm (16.9 in)
Depth: 26.7 cm (10.5 in)
Weight: 6 Kg (13.2 lb)

STANDARD ACCESSORIES
☐ Fuse 0.3A 220V: 240 VAC
☐ 2 Paper clamps
☐ Operator's manual
☐ Black, red and blue pens

OPTIONAL EQUIPMENT

Pens: Eight colors

HPGL ROM SET Now available for an additional charge of $150.00

We have only 100 at this Super Special Price so get your order to us before we

SELL OUT

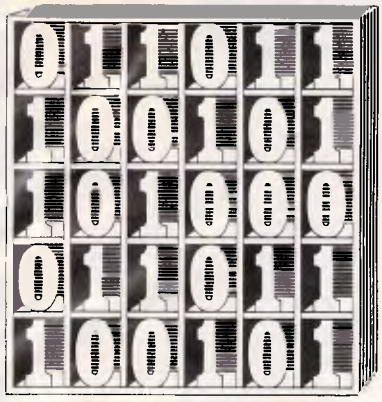
This offer will not be repeated place your order now

NATIONAL CAD SOLUTIONS

P.O. BOX 30 STAFFORD QUEENSLAND 4053

07 352 6257

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Subset, APC, 2nd Floor, 215 Clarence Street, Sydney 2000.

6809 BIT ROTATION

CHROT (Datasheet 1) from F Ellahi is a 6809 version of the character rotation routine. Corresponding 6502 and Z80 versions can be found in the January issue. 68000 and 8086 versions do not exist yet.

As the temporary result storage space used by CHROT is appended to the routine, it can be initially indexed by using the 6809's Program Counter Relative effective address mode. This makes the routine's code relocatable to anywhere in memory, but prevents both ROM-fixing of the routine and also re-entry from an interrupting program. An alternative method would be to initialise the temporary storage on stack above the stack pointer.

None of the rotation routines is particularly quick. The 6809 and Z80 routines take 1544 and 3191 clock cycles respectively to rotate one small character anywhere in memory. The 6502 version is possibly the most trim, taking only 919 cycles to rotate an 8-bit by 8-bit matrix located in page zero — both the source and result matrices could need to be transferred, and that would add significantly to the overall time.

The slowness of these routines would not be noticeable were they employed to convert horizontal screen images to the vertical Epson standard bit image modes, as printing is such a slow operation. If, however, they are to be used for real-time graphics on a bit-mapped screen, then the slowness could be all too apparent with no more than a hundred or so characters rotated in 0.1 seconds.

Any significant timing improvements would be welcome, as would routines to effect quick rotations on larger images.

DATASHEET 1

```
:
:= CHROT    Rotate an 8 × 8 character matrix.
:
:JOB        To rotate an 8 × 8 bit matrix, stored as eight
:           contiguous bytes, anticlockwise by 90 degrees,
:           storing the result in the original source space.
:ACTION     For source byte 7 to source byte 0
:           [ For result byte 0 to result byte 7
:             [ Shift source lsb to Carry.
:               Rotate Carry into result byte msb. ] ]
:           Copy result 8-bytes to source location.
:
:CPU        6809.
:HARDWARE   None.
:SOFTWARE   None.
:
:INPUT      8-byte source matrix at (X+0) to (X+7).
:OUTPUT     8-byte result matrix at (X+0) to (X+7). X unchanged.
:           CC changed. All other registers unchanged.
:ERRORS     None.
:REG USE    X, CC
:STACK USE  (S): 10
:RAM USE    None.
:LENGTH     48 (code: 40.  temporary storage: 8).
:CYCLES     1544
:
:CLASS 2     -discreet      *interruptable     -promable
:-*--**      -reentrant     *relocatable       *robust
```

```
:
CHROT   PSHS U,X,D      :Save registers used in CHROT.     34 56
        LEAU TEMP,PCR   :Address appended temp store.      33 8C 23
        PSHS U,X        :Save temp & source addresses.     34 50
        LEAX 7,X        :Address source last byte.         30 07
        LDA  #8         :Count for 8 source bytes.         86 08
:
OUTER   LDU  2,S        :Get temp result start address.    EE 62
        LDB  #8         :Count for 8 temp result bytes.    C6 08
:
INNER   LSR  ,X         :Get next source bit, this byte,   64 84
        ROR  ,U+        :into next result byte msb.        66 C0
        DECB            :Repeat for all 8 bits from one    5A
        BNE  INNER      :source byte into 8 result bytes.  26 F9
:
        LEAX -1,X       :Address next source byte and      30 1F
        DECA            :repeat until all 8 source bytes   4A
        BNE  OUTER      :are rotated into result bytes.    26 F0
:
        PULS U,X        :Restore temp & source addresses.  35 50
        LDB  #8         :Count for 8 byte transfer.        C6 08
:
COPYLP  LDA  ,U+        :Get next temp result byte to      A6 C0
        STA  ,X+        :source location, indexing next    A7 80
        DECB            :byte of each and repeat until     5A
        BNE  COPYLP     :all 8 result bytes are moved.     26 F9
:
        PULS D,U,X,PC   :Restore regs and exit CHROT.      35 D6
:
TEMP    RMB  8          :8-byte temp store appended to CHROT.
:
```

Z80 SCREEN COMPRESSION

Regular readers will know that John Hardman has already contributed many useful and intriguing routines to the SubSet library. His latest offerings, COMPCT (Datasheet 2) and its inverse EXPAND (Datasheet 3), are no exception.

They provide a magnificently simple method of compressing large data blocks for more rapid tape storage or for disk economy.

The system used by COMPCT/EXPAND depends entirely on the probability that long sequences of identical byte values will occur in the source data. Each sequence is reduced by COMPCT to two bytes of information — the value of the repeated byte and a count of the repetitions up to a maximum of 256. EXPAND uses the two bytes to write a string of identical values to the destination area.

The most obvious application is in compacting full graphics screens with large background areas, block colours and horizontal lines, either for quicker storage on a slow medium or to fit a complete sequence of motion 'frames' on one disk. In a best-case situation, where each different value is repeated 256 times, 16k of screen data would be compressed to a mere 128 bytes. By keeping the images simple, one disk could hold a couple of minutes of moving graphics.

Conversely, the compacted data of a very complex screen image might end up longer than the original. The worst case would be a screen with no consecutively identical values. Such an unlikely phenomenon would

PROFOUND

IBM PC/XT COMPATIBLE

ANNOUNCING SYDNEY OPENING

DEALER ENQUIRIES WELCOME

IBM SOFTWARE

	OUR PRICE	RRP
LOTUS 1-2-3 VERS 2	535	835
SYMPHONY	725	1095
DBASE 2	495	678
DBASE 3+	795	995
PARADOX	795	995
PFS FILE	195	215
PFS PLAN	195	215
PFS REPORT	195	215
PFS GRAPH	195	215
PFS WRITE	195	215
AUDITOR VERSION 2	195	215
BOTTOMLINE IV	295	365
SPOTLIGHT	195	235
SIDEWAYS	85	95
STARBRIDGE	65	70
SIDEKICK (UNPROTECTED)	125	135
THINK TANK	250	295
TURBO PASCAL	99	119
TURBO PASCAL 8087	160	180
TURBO TUTOR	60	65
TURBO TOOLBOX	80	90
DATABASE TOOLBOX	90	99
TURBO LIGHTENING	130	145
QUICKCODE II	365	405
DUTIL III	135	145
QUICK REPORT III	365	405
WORDSTAR	340	445
WORDSTAR 2000 VER 2	455	595
WORDSTAR 200 PLUS	545	695

PR-02 PROFOUND STANDARD

* 256K RAM
* 8 SLOT MOTHERBOARD
* VIDEO BOARD
* PARALLEL PRINTER PORT
* SERIAL PORT RS-232
* REAL TIME CLOCK/CAL.
* JOYSTICK PORT
* 2 x 360K FLOPPY DRIVES

$1,499

THE SPECIAL

* PR-02 COMPUTER
* GREEN OR AMBER MONITOR
* BROTHER M-1109 PRINTER

PLUS . . .

FREE BONUS

* PRINTER CABLE
* PRINTER PAPER
* JOYSTICK
* 10 BLANK DISKETTES
* DISK STORAGE BOX

$2,148

HARD DISKS

— 10 MBYTE & CONTROLLER $950
— 20 MBYTE & CONTROLLER $1250

MONITORS

— COMPOSITE HI-RES GR OR AM $199
— TTL & COMPOSITE $299
— INTRA 14" COLOR HI-RES $690
— PHOENIX IV 14" COLOR $790

PRINTERS

— BROTHER M-1109 80 COL $450
— BROTHER M-1509 132 COL $699
— TWINWRITER 5 DUAL-HEAD $1850
— NAKAJIMA NP-2200 165 CPS $650
— NAKAJIMA AP-650 D/WHEEL $650

OTHER

— MICRDSDFT MOUSE $250
— Z-NIX MOUSE $125
— INTERLINK 12/75 MODEMS $299
— IBM COMPATIBLE JDYSTICK $50
— 10 BLANK DISKETTES DSDD $35
— DISK STORAGE BOX $25
— PRINTER CABLE $35
— PRINTER PAPER 80 COL 2000 . . . . . $48

All Systems backed by:

- COMPREHENSIVE WARRANTY
- TECHNICAL SUPPORT
- FRIENDLY SERVICE

EME

EASTERN MICRO ELECTRONICS SALES P/L

MELBOURNE
92-94 Bank Street
South Melbourne Vic 3205
Ph: (03) 699 3088

SYDNEY
Gnd Floor, Fortune House
88 Foveaux Street
Surry Hills NSW 2010 Ph: (02) 212 6944

result in a 'compacted' block twice the length of the original data.

Although John's tests have shown that the average compression of screens displaying cartoon characters is about ⅛ of the original size, he suggests playing safe by comparing the compacted result from COMPCT with the original to determine which should be stored.

DATASHEET 2

```
;
;= COMPCT    Compact screen data.
;

;JOB         To compact data containing sequences of identical
;            value bytes, e.g. screen data.
;ACTION      WHILE src-cnt > 0
;            [ Occurrence-cnt = 0.
;              Value-byte = (src-ptr).
;              REPEAT UNTIL src-cnt = 0
;                     OR occurrence-cnt = 256
;                     OR value-byte <> source-byte
;               [ Src-ptr = src-ptr + 1.
;                 Occurrence-cnt = occurrence-cnt + 1.
;                 Src-cnt = src-cnt - 1.
;                 IF scr-cnt > 0 THEN
;                 [ IF occurrence-cnt < 256 THEN
;                   [ Source-byte = (src-ptr).
;                     Compare value-byte with source-byte. ] ] ]
;             (Dst-ptr) = occurrence-cnt, dst-ptr = dst-ptr + 1.
;             (Dst-ptr) = value-byte, dst-ptr = dst-ptr + 1. ]
;
;CPU         Z80.
;HARDWARE    Source and destination RAM.
;SOFTWARE    None.
;
;INPUT       BC holds number of source bytes to compact.
;            DE addresses compact destination 1st byte.
;            HL addresses source 1st byte.
;OUTPUT      BC holds number of compacted data bytes.
;            All other registers and flags are unchanged.
;ERRORS      No check for destination overwrite of source data.
;REG USE     BC DE HL
;STACK USE   10
;RAM USE     None.
;LENGTH      56
;CYCLES      Not given.
;
;CLASS 2     *discreet      *interruptable      *promable
;*****-      *reentrant     *relocatable        -robust
;

;
COMPCT PUSH AF          ;Save flags and accumulator.        F5
       PUSH HL          ;Save source start address.         E5
       PUSH IX          ;Save IX and use as dest pointer,   DD E5
       PUSH DE          ;getting address from DE, so DE     D5
       POP  IX          ;free for byte & count regs.        DD E1
;
       PUSH DE          ;Save destination start address    D5
                        ;last for computing dest length.
;
NXTBYT LD   A,B         ;Test source byte count in BC       78
       OR   C           ;and terminate if initially zero    B1
       JR   Z,END       ;or compaction completed.           28 1E
;
       LD   D,0         ;Zeroise occurence count for next   16 00
       LD   E,(HL)      ;byte in D; get next byte in E.     5E
;
LOOP   INC  HL          ;Address next source byte and       23
       INC  D           ;increment occurence count.         14
       DEC  BC          ;count off source byte got then     0B
       LD   A,B         ;test if end of source data         78
       OR   C           ;reached, storing byte & count      B1
       JR   Z,STORE     ;to destination if so.              28 08
;
       INC  D           ;Else test for max count of         14
       DEC  D           ;256 (D = 00H), store byte &        15
       JR   Z,STORE     ;count to destination if so.        28 04
;
       LD   A,(HL)      ;Else read next byte and compare    7E
       CP   E           ;to previous byte, loop to inc      BB
       JR   Z,LOOP      ;occurence count if same value.     28 F1
;
STORE  LD   (IX+0),D    ;Store byte occurence count         DD 72 00
       INC  IX          ;to destination, followed by        DD 23
       LD   (IX+0),E    ;byte value, incrementing           DD 73 00
       INC  IX          ;pointer to next location.          DD 23
       JR   NXTBYT      ;Go do next, or terminate.          18 DE
;
END    PUSH IX          ;Move destination + 1 address       DD E5
       POP  HL          ;into 16-bit accumulator, get       E1
       POP  DE          ;destination start address in DE.   D1
       AND  A           ;Clear carry for subtraction.       A7
       SBC  HL,DE       ;Compute length of compacted        ED 52
       LD   B,H         ;data and move into BC for          44
       LD   C,L         ;output information.                4D
;
       POP  IX          ;Restore IX.                        DD E1
       POP  HL          ;Restore source pointer.            E1
       POP  AF          ;Restore accumulator & flags.       F1
       RET              ;Exit, data compacted.              C9
;
```

FREE

Subscription offer to all professionals in the computing industry

Computing Australia is the nation's leading weekly newspaper in the computing field. Hard-hitting news, interviews with the people who count and the best positions vacant section of any computer publication in the country.

Clip & Post Today

To: The Circulation Manager, Computing Australia, 2nd floor, 215 Clarence Street, Sydney 2000

AFFIX YOUR BUSINESS CARD HERE

I am interested in applying for a subscription to Computing Australia, the weekly newspaper for company executives and computer professionals.

Signature _____

DATASHEET 3

```
;═══════════════════════════════════════════════════════════════
; = EXPAND    Expand compacted screen data.
;═══════════════════════════════════════════════════════════════
;JOB         To expand data containing sequences of identical
;            value bytes compacted to value + occurrence count
;            byte pairs, e.g. screen data.
;ACTION      Src-cnt = src-cnt / 2.
;            WHILE src-cnt > 0
;            [ Occurrence-cnt = (src-ptr), src-ptr = src-ptr + 1.
;              Value-byte = (src-ptr), src-ptr = src-ptr + 1.
;              REPEAT UNTIL occurrence-cnt = 0
;              [ (Dst-ptr) = value-byte.
;                Dst-ptr = dst-ptr + 1.
;                Occurrence-cnt = occurrence-cnt - 1. ] ]
;─────────────────────────────────────────────────────────────
;CPU         Z80.
;HARDWARE    Source and destination RAM.
;SOFTWARE    None.
;─────────────────────────────────────────────────────────────
;INPUT       BC holds number of source bytes to expand.
;            DE addresses expand destination 1st byte.
;            HL addresses source 1st byte.
;OUTPUT      BC holds number of expanded data bytes.
;            All other registers and flags are unchanged.
;ERRORS      No check for destination overwrite of source data.
;REG USE     BC DE HL
;STACK USE   8
;RAM USE     None.
;LENGTH      34
;CYCLES      Not given.
;─────────────────────────────────────────────────────────────
;CLASS 2      *discreet      *interruptable      *promable
;*****-       *reentrant     *relocatable        -robust
;═══════════════════════════════════════════════════════════════
;
EXPAND PUSH AF          ;Save accumulator and flags.          F5
       PUSH HL          ;Save source start address.           E5
;
       PUSH DE          ;Save dest start address last for     D5
                        ;computing dest length.
       SRL  B           ;Source bytes / 2 gives no. of        CB 38
       RR   C           ;different source value bytes.        CB 19
;
NEXT   LD   A,B         ;Test source count in BC and          78
       OR   C           ;terminate if initially zero          B1
       JR   Z,DONE      ;or expansion completed.              28 0D
;
       PUSH BC          ;Save source count and get            C5
       LD   B,(HL)      ;occurrence count in B, bump          46
       INC  HL          ;source pointer and get               23
       LD   A,(HL)      ;value byte in A.                     7E
       INC  HL          ;Address next count/value pair.       23
;
OUTPUT LD   (DE),A      ;Store occurrence of value byte       12
       INC  DE          ;and address next dest location,      13
       DJNZ OUTPUT      ;repeat for all occurrences.          10 FC
;
       POP  BC          ;Restore source count and count off   C1
       DEC  BC          ;value just written to destination.   0B
       JR   NEXT        ;Repeat for all source values.        18 EF
;
DONE   EX   DE,HL       ;Move destination + 1 to 16-bit       EB
       POP  DE          ;accumulator, get dest start address  D1
       AND  A           ;Clear Carry for subtraction.         A7
       SBC  HL,DE       ;Compute expanded destination         ED 52
       LD   B,H         ;byte length and move to BC           44
       LD   C,L         ;as output information.               4D
;
       POP  HL          ;Restore source start address.        E1
       POP  AF          ;Restore accumulator and flags.       F1
       RET              ;Exit, data expanded.                 C9
;═══════════════════════════════════════════════════════════════
```

COMPACT IMPROVEMENTS

I know that John is always eager to improve the implementations of his ideas, so I hope he doesn't mind a few suggestions and a little criticism.

The sequence of three instructions used in COMPCT to save IX and then transfer the destination address from DE to IX takes five bytes and 40 clock cycles, as shown in the LONG section of Fig 1. A better method is shown in the SHORT section. This uses one of the Z80's stack exchange instructions to save two bytes and six clock cycles, as well as reducing the process's stack use from

Good News...

gametronics

'THE MASTER' MICRO

Following the success of the BBC Micro, The Master Series is set to dominate the PC marketplace. With technically excellent features such as 32 bit scientific power, 16 bit IBM & MS-DOS compatibility and turbo 8 bit software processing, The Master is set to conquer. Using ½Mb of RAM, GEM and a mouse, a master can deliver mainframe type performance to your desktop. Come in and see the masters for a great deal on BBC equipment.

We stock a comprehensive range of

- Business software
- Latest games
- Educational programs
- Hardware

FOR THE MASTER SERIES AND THE BBC B/B+

RAMPAGE PC/XT

If quality counts there is no better machine than ours. We are so confident we back up our machine with a *full 12 month warranty*

Features:

- 640K on motherboard
- Serial port
- Colour or mono card
- Clock calendar
- 12 month warranty
- Free PC DOS while stocks.
- 2 x 360K drives
- Centronics port
- 135 watt power supply
- Excellent backup
- PC/AT style keyboard

We can also configure systems to your exact needs

ONLY $2200.00

AMSTRAD PCW 8256

The complete business solution

- 256K Ram
- 3½" 180K drive
- NLQ printer
- IBM style detachable keyboard
- High resolution green screen monitor
- 90 column x 32 line display
- CPM plus operating system
- Gem (Icon Software)
- "Pull down menu" word processor
- Ultrafast Mallard basic
- Digital Research Logo

ALL THIS FOR AN INCREDIBLE $1450.00

SINCLAIR QL

32 bit micrprocessor includes

Wordprocessor
Spreadsheet
Database
Graphing package

$795.00

SPECTRUM PLUS STARTER PACK

Britains top selling microcomputer only **$349.00** gets your Spectrum and twelve free programs*

*while stocks last

gametronics

6/177 Toorak Road, South Yarra 3142. (03) 241 3031

Mail Order/Cheque or any credit card.
Please send me

- ☐ *your Spectrum catalogue*
- ☐ *your BBC catalogue*
- ☐ *your QL catalogue*
- ☐ *your Commodore catalogue*
- ☐ *520 ST information*
- ☐ *amstrad information*

ITEMS ..... @ $.....
..... $.....
..... $.....
Add $8.50 P&P H/ware or $2.50 S/ware: $.....
$_____

Name .....
Address .....
..... *Phone* .....
Signature .....
Bankcard No. ..... *Exp. Date* .....

four to two bytes. The transfer of the destination end address from IX to HL and the restoration of IX in the END section of COMPCT can be cut from five to three bytes, similarly if DE is first restored.

I am never happy about using the Z80's IX or IY registers. They do not have anything like the flexibility afforded by the index registers or addressing modes of the 6502, 6809 or 68000, and always seem to consume bytes and time states as though there were no tomorrow. Consequently, I am always sorely tempted to rearrange routines which employ IX or IY, just to see if they do indeed operate more efficiently when limited to the 8080 register set AF, BC, DE and HL.

In the case of COMPCT, I was able to knock out 11 bytes by replacing John's use of IX with top-of-stack storage accessed by EX (SP), HL in the STORE section. The cost of this reduction in length is an increase of six clock cycles in the operating time of STORE. The slight increase in STORE timing can be more than offset in the LOOP section by testing the occurrence count D before the source count BC, and this also saves another two bytes. The change is shown in Fig 2.

Fig 1

```
;
;                                                cycles   code
;
LONG    PUSH IX          ;Save IX                  15      DD E5
        PUSH DE          ;Move DE to               11      D5
        POP  IX          ;IX via stack.            14      DD E1
;
SHORT   PUSH DE          ;Move DE to IX            11      D5
        EX   (SP),IX     ;via stack, saving IX.    23      DD E3
;
```

Fig 2

```
;
;
LOOP    INC  HL          ;Address next source byte and      23
        DEC  BC          ;count off source byte got then    0B
        INC  D           ;increment occurence count but exit 14
        JR   Z,STORE     ;loop if count = 256.              28 08
;
        LD   A,B         ;Test if end of source data        78
        OR   C           ;reached, storing byte & count     B1
        JR   Z,STORE     ;to destination if so.             28 04
;
        LD   A,(HL)      ;Else read next byte and compare   7E
        CP   E           ;to previous byte, loop to inc     BB
        JR   Z,LOOP      ;occurence count if same value.    28 F3
;
STORE   EX   (SP),HL     ;Get dest address, saving source   E3
        LD   (HL),D      ;address on stack, and store       72
        INC  HL          ;occurrence count followed by      23
        LD   (HL),E      ;value byte, moving dest address  73
        INC  HL          ;on for next byte pair. Save dest  23
        EX   (SP),HL     ;address, restore source address  E3
        JR   NXTBYT      ;and repeat until source end.      18 E4
;
;
```

V COMPUTERS VIATEL

Vic. Distributor

24 Burwood Highway
Burwood 3125

288 2144

Whyalla Copy Centre

Whyalla Copy Centre

S.A. Distributor
76 Effington Lewis Avenue,
Whyalla

(086) 45 7755

$4700

PC Compatible 640K

with 2 Drives
2 RS232 Ports
RGB Colour Port Green Monitor
1 Parallel Port
1 Games Port
1 Light Pen Port
Extra Slot For Mouse
1-20 Meg Hard Drive
1-20 Meg Streaming Tape Backup
1 Modem
Complete with 2 Meg of Software

UPGRADE YOUR PC
MAKE IT STRONGER THAN AN AT

* Speed Card over 200% has 8086 10Mhz	**$495**
* STB Colour Card for Better Colour. 16 Colours	**$450**
* STB Graphic Plus II 640x200 4 Colour. 320x200 16 Colours	**$790**
* UPS Power Supply. 200 watt. Battery Backup. Uninterruptable Power. Approx. 30 minutes power	**$650**
* Public Domain Software. Over 100 to choose from	**$10** *each*
* MODEMS — 300/1200-75. We have communication software	*from* **$195**
* Streaming tape backup. 20 Meg Internal	**$1630**
* Baud Rate Converter (Answer & Originate)	**$190**
* Viatel Software & Modems for PC/APPLE	**CALL**
* 20 Meg Hard Drive with DTC Controller Card	**$1225**
* SERVICE & REPAIRS ON COMPUTERS Maintenance Contracts available on site if required	**CALL**
* Diskettes SS/SD **$1.70** inc. Tax each	
* Agents for Copal & Brother Printers	**CALL**
Agents for 3M Magnetic Media	**CALL**

Wheels of fortune

Peter Tootill and Steve Withers present the story of Steve Roberts, who has travelled round the US with the help of a bicycle and an online network system, CompuServe. There's also an update of telex news.

For over a year Steve Roberts has been travelling around the US on a bicycle — a rather unusual bicycle. It's a 'recumbent' type which you ride lying back instead of sitting upright — which has enabled him to carry a reasonable amount of luggage with him. He has travelled nearly 10,000 miles, suffered several punctures and a wreck, but no broken bones.

Steve Roberts is an electronic engineer turned computer writer. To fund his trip, he continued to write on his travels. Being used to all the panoplies of the electronic age, this presented a problem. How do you carry a wordprocessor on a bicycle? Indeed, this problem proved too much for Steve on his first attempt at such a venture about five years ago, using an ordinary bicycle and a computer built into a trailer. The result was a torn ligament on a training ride, which effectively killed off the idea for a few years.

Three things then happened to make the idea possible: the advent of real portable computing with the Tandy Model 100; the recumbent bicycle; and (and this is the reason for reporting the story here) an online network called CompuServe. Using the recumbent bike, Roberts can carry about 200lbs of baggage, including a solar panel to recharge the batteries on his computer — the Model 100 was eventually superseded by a Hewlett-Packard 110 portable. Other equipment includes a CB radio, an anti-theft system, an altimeter, a digital speedo and a flashing orange beacon.

Roberts stops overnight in motels, sometimes for a few days but never longer, and carries on with his writing. When he is ready, he uses the nearest public telephone to 'upload' his writings to his own file storage area on the CompuServe system. CompuServe has plenty of storage space and text editing facilities, so Roberts can add to and polish his copy, using his portable computer as a terminal. In this way he doesn't need to worry about cassettes or portable disk drives for data storage. When he is happy with his article, it can be sent to one of his publishers — directly in the case of CompuServe itself, which is publishing a series of articles on his travels in its electronic magazine.

Roberts also has an assistant called Kacy with whom he keeps in touch via electronic mail using CompuServe's 'e-mail' system. She can download and print the files when a publisher is so behind the times as to require paper. Kacy also handles correspondence, much of it electronic, manages the money, schedules projects, and generally acts as an interface between Roberts and the world. The system seems to have worked well, as Roberts has covered nearly 10,000 miles in the last year or so.

Information utilities

CompuServe is one of two major networks in the US; the other is called the Source, and together they are often referred to as 'information utilities'. They offer a much wider service than Viatel, and are not tied to the viewdata format. While both systems seek to cover a wide range of markets, CompuServe seems to lean a little towards the home users, and the Source to business users. Both can be accessed from outside the US, but CompuServe doesn't encourage overseas users.

Telexes

Telexes have long been a popular method of communication for larger businesses, but the cost of the equipment has been beyond the smaller business or the individual user. These days, using online systems such as Viatel and Teledata, anyone with access to a terminal and a modem can send and receive telexes at a reasonable cost, even to ships at sea.

Viatel users have been able to send telexes for some time inland, and the service will soon be extended to allow users to send and receive both inland and overseas telexes.

Sending a telex is easy: for example on Viatel you follow the menus down to the appropriate page (or remember *8161#), and then fill in a form in much the same way as for an ordinary Viatel mailbox message; the form has a space for the recipient's telex number. The system sends you confirmation of delivery (and you don't pay unless it is delivered). Other systems work in much the same way.

When incoming telexes are handled, they are directed to the relevant system's telex account and only need to quote the addressee's mailbox or account number at the start of the message to ensure correct delivery.

The cost of the service varies depending on the online system used. Viatel charges $1.75 for telexes of up to one frame (about 100 words).

Teledata's charges are based on the actual time taken to transmit the message, and were $2/min for international telexes and 45¢/min inland (25¢/min off-peak). However, an announcement of new rates was imminent at the time of going to press.

Notification of incoming messages may be arranged at additional cost.

Microtex 666

The major effort at Microtex is still the expansion and re-indexing of the telesoftware library. We understand the backlog of programs for currently supported computers has almost been cleared, and the first Sega programs will soon appear. A list of the 10 most popular programs in the library will be updated each month, and the "what's new" list should change each week.

Work is continuing on the software to run Microtex's multi-player game, "The Great Galactic Conflict". By the time you read this, a major test run should be in progress, with the start of the first game in late March or April.

Due to the popularity of the "free Sundays" that occur from time to time on Viatel, the Microtex bulletin boards will be updated every 15 minutes during such weekends.

Microtex 666 videotex packages will soon be available for the IBM PC, Apple II, and BBC computers as well as the Commodore 64.

The IBM PC package can be used in three modes: full colour with "nearest equivalent" graphics; limited colour with full Viatel graphics; or (with an optional ROM) full colour with full graphics. Hayes-standard autodialling is supported, and 1200/75 baud is provided without hardware modifications. Just in case a user already has a modem with a built-in bit rate converter, the package will also work at 1200/1200 baud.

The Apple II program will only provide monochrome images, but a colour version is also planned.

Unlike the other Microtex packages, the BBC implementation comes in ROM and also makes use of the BBC's built-in videotex display mode. However, it is a full communications package, not limited to videotex alone.

All the Microtex packages provide page storage and print screen facilities, and include telesoftware downloaders that are fully tested with the Microtex library. The library will be used to provide users with updated software — new versions of the Modem 64 and Term 64 public domain programs supplied with the Commodore package will soon be available, and a whole range of printer drivers for the BBC package will appear in due course.

The $499 price of the packages ($399 for the C64) includes a Sendata modem, software-only prices will soon appear.

In case there is any confusion, these packages are developed and marketed for Microtex 666 by Information Solutions, telephone (03) 419 0300.

Bludner

Right in the middle of the January article about password security, was what looked like a typo — actually, it was our fault (OK, *my* fault — SW). What we were trying to say was that Telecom charge $50 to change an Austpac account number.

Corrections and Updates

ACRIBBS. Permanently off-line.

CocoLink. (075) 32 6370. Previously referred to as Coco-Line in this column.

SCUA RCPM/RBBS. (03) 754 5081. MV. David Woodberry. 24 hours daily. Public domain software downloading for members of Sorcerer and CP/M Users of Australia, Inc.

Eastwood RCPM. (03) 870 4623. Mick Stock. 4pm-midnight, Monday-Friday ONLY. V21 originate or answer due to poor line quality. Previously referred to as East Ringwood RCPM.

Omen RTRS. (02) 498 2495. P. Ted Romer. 4.30pm-9am weekdays, 3pm-9am weekends. V21 and V23.

New Listings

Andromeda (02) 764 3598. 24 hours.

Ace BBS (02) 560 9846. 6pm-9am weekdays, 24 hours weekends.

Augur TBBS (02) 661 4739. Mark James. 24 hours.

Csace BBS (02) 529 8249. 24 hours.

Frontier Systems RIBM. (02) 875 2606. 24 hours.

Galaxy RAPL (02) 875 3943. 24 hours.

Pursuit BBS (02) 522 9507. 24 hours.

Sentry BBS (02) 428 4687. 9pm-6am weekdays, 8pm-6am weekends.

Sydney PC Users Group RIBM (02) 238 9034. 24 hours.

Abcom RIBM (047) 36 4165. 24 hours.

Illawarra BBS (042) 84 4354.

Apple Hackers BBS (03) 762 1582. 3pm-6.15pm weekdays, 24 hours weekends. Password: AHUBBS

Down Under Software RIBM (03) 429 5819. 24 hours.

Hi-Tech BBS (03) 397 1165. 24 hours.

Millionaire BBS (03) 222 2939. P. Jon Grant. 24 hours. Caters for a wide range of machines.

Public Resource #1 BBS (03) 878 2918. 24 hours.

Launceston BBS (003) 34 0911. 24 hours.

Ian Campbell TBBS (003) 26 4248. 24 hours.

Omen V (08) 356 7939. 24 hours.

Applecross (09) 364 9924. 24 hours.

Omen Mini (09) 279 8555. 24 hours.

All details provided in this column are believed to be correct, but we welcome new information. Please mention whether you have first hand knowledge of the systems you tell us about, or are simply passing on information from another source. Viatel users can send messages to Mailbox 063000030, users of RUNX and other systems on ACSnet can mail to stephenw@murdu, and letters may be addressed to Steve Withers, C/- *Computer Publications*, 77 Glenhuntly Rd, Elwood, Victoria 3184. END

'This is the Hemmingway word processor, sir. It only works with a bottle on it.'

ATLANTIS INTERNATIONAL COMPUTERS

IMPORTERS
SUPPLIERS
DISTRIBUTORS
& SALES

49 WADHAM PARADE, MT. WAVERLEY, VIC. 3149

PHONE: 277 3139, 277 7187, 277 9514

ATLANTIS PC 256K RAM (EXPANDABLE TO 640K) 8088 PROCESSOR

2 x TEAC (JAPANESE) DISK DRIVES
1 x MULTIFUNCTION CARD
1 x SERIAL PORT
1 x CENTRONICS PORT
1 x JOYSTICK PORT
1 x COLOR GRAPHICS CARD
1 x RGB PORT
2 x COMPOSITE PORTS
CLOCK/CALENDAR
TOTAL PRICE

EX-STOCK
ATLANTIC PC/XT

$1600 EX-TAX

IBM COMPATIBLE PC/XT 640K RAM

MONITORS

COMPOSITE MONITOR	$180
TTL ORANGE	$229
TTL GREEN	$229
ROLAND COMPOSITE	$199
MONITOR CABLE	$29
MONITOR STANDS	$29
ROLAND COLOUR MONITOR	$899
ATLANTIS D+X2001	$599

INTERFACE FOR IBM OR COMPATIBLES

MULTIFUNCTION CARD 384K/0K	$180
MEMORY CARD 0 TO 1MG	$99
MONO GRAPHIC (HERCULES) CARD	$150
COLOUR GRAPHIC (IBM)	$159
PARALLEL INTERFACE	$65
SERIAL INTERFACE	$79
DISK DRIVE CARD	$86
DISK DRIVE CABLE FOR ABOVE	$25
DISK/MULTI IO CARD	$209
CABLE FOR ABOVE	$25
HARD DISK CONTROLLER	$318
IBM DISK DRIVE SANYO OR TEAC	$229
JOY STICK	$45
PRINTER CABLE	$29
REPLACEMENT KEYBOARD	$150
REPLACEMENT KEYBOARD (KETRONIC)	$239
PC SUPER MODEM 1200/75 300	$239
MODEM PHONE WITH VIATEL AND SOFTWARE	$279

TAX PAID

SPECIALS

HARD DISK

20MG AND CONTROLLER	$1400
10MG AND CONTROLLER	$1050

Installed free

DISKETTES From **$1.69** each (X) tax

2000 SHEETS OF PAPER	$38

PRINTERS GALORE

SUPER 5 EP 1201	$479
SUPER 5 EP 1802	$699
CPB 80 130 CPS	$395
CPB-136P 130 CPS 15 INCH	$799

★ For your printer requirement, ring. A.I.C. will match or beat any price on printers in this issue

8087 CO-PROCESSOR

$289

LIMITED QUANTITY

FREE-FREE-FREE-FREE-FREE
LOG ON TO OUR RBBS
24 HOURS FREE. PH 277 6824

NOTE:
- DEALER ENQUIRIES WELCOME
- DELIVERY EXTRA
- ALL PRICES INCLUDE SALES TAX
- ATLANTIS INTERNATIONAL ARE LOOKING FOR NEW DEALERS INTERSTATE
- A.I.C. ACCEPTS BANKCARD, VISA, AND CHEQUES
- PLEASE ALLOW 3 OR 4 DAYS DELIVERY

BENCHMARKS

A list of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END

100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END

100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END

100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN

100 REM Benchmark 6
110 PRINT "S"
120 K=0
```

```
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GUSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN

100 REM Benchmark7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 IF K<1000 THEN 140
210 PRINT "E"
```

```
220 END
230 RETURN

100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K  2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

Japan	Comdex in Japan '86 Contact: Comdex in Japan Executive Committee, Kashiwabara Bldg, 2/F1, 1-3-3 Kyobashi, Chuo-ku, Tokyo 104, Japan (03) 271 0246	March 3-6, 1986
Sydney	PC86 Conference Contact: ACS, NSW (02) 233 7677	March 12-14, 1986
Sydney	6th Australian Personal Computer Show Contact: Ms F Michael, Australian Exhibition Services Pty Ltd, (03) 267 4500	March 12-15, 1986
London	Info '86 Contact: BED Exhibitions Ltd, 44 Wallington Square, Wallington, Surrey, England SM6 8RG	March 24-27, 1986
Houston, Texas	OAC '86 Contact: OAC '86, C/o AFIPS, 1899 Preston White Drive, Reston, Virginia 22091, US (703) 620 8926	March 24-26, 1986
Melbourne	MacWorld '86 Contact: (02) 439 5133	April 16-19, 1986

NUMBERS COUNT

Mike Mudge looks at the construction of tables of primitive roots and indices in number theory.

This topic is fundamental to many primality-testing algorithms, also to the solution of various types of linear and non-linear congruence.

Definition D1. Two positive integers b and c are said to be congruent modulo m if, and only if, they differ by an integer multiple of m.

We write $b \equiv c \pmod m$ meaning $b = c + km$ where $k = 0, +1, +2,$. For example, $13 \equiv 98 \pmod 5$ because $13 = 98 + (-17)(5)$.

Definition D2. Euler Phi-function $\phi(n)$ is defined to be the number of positive integers not exceeding the given positive integer n which are relatively prime to n (that is which share no common factor, other than 1 with n). For example, $\phi(4) = 2$, $\phi(12) = 4$, $\phi(p) = p - 1$ where p is prime.

Definition D3. Let a and m be relatively prime positive integers, then the least positive integer, x, such that $a^x \equiv 1 \pmod m$ is called the *order* of a *modulo* m. We write $x = \mathrm{ord}_m a$. For example, $\mathrm{ord}_7 2 = 3$, $\mathrm{ord}_7 3 = 6$, $\mathrm{ord}_{17} 5 = 16$.

Definition D4. If r and n are relatively prime integers, and if further $\mathrm{ord}_n r = \phi(n)$, then r is called a primitive root modulo m. For example, 2 is a primitive root modulo 9.

Now when an integer possesses a primitive root, it usually has many primitive roots.

Theorem T1. If a positive integer, m, has a primitive root then it has a total of $\phi(\phi(m))$ incongruent primitive roots.

Theorem T2. The positive integer n possesses a primitive root if, and only if, $n = 2, 4, p^t$, or $2p^t$, where p is an odd prime and t is an integer.

Problem A. Write a computer program to:

(i) find primitive roots modulo powers of a given odd prime; and

(ii) find primitive roots modulo twice the powers of a given odd prime.

Test. 7, 13, 17 and 19 are all the incongruent primitive roots modulo 22.

5 is a primitive root moduli 23, 529, 1058.

3 is a primitive root moduli 17, 289, 578.

Definition D5. Let m be a positive integer with primitive root r. If a is a positive integer which is relatively prime to m, then the unique integer, x, with $1 \leqslant x \leqslant \phi(m)$ and $r^x \equiv a \pmod m$ is called the *index* of a to the *base* r *modulo* m: we write $x = \mathrm{ind}_r a$ and do not display the base explicitly since it is assumed to be fixed at a known value.

For example, modulo 7. $\mathrm{ind}_3 1 = 6$, $\mathrm{ind}_3 2 = 2$, $\mathrm{ind}_3 3 = 1$, $\mathrm{ind}_3 4 = 4$, $\mathrm{ind}_3 5 = 5$ and $\mathrm{ind}_3 6 = 3$. However, a change of primitive root from 3 to 5 yields $\mathrm{ind}_5 1 = 6$, $\mathrm{ind}_5 2 = 4$, $\mathrm{ind}_5 3 = 5$, $\mathrm{ind}_5 4 = 2$, $\mathrm{ind}_5 5 = 1$ and $\mathrm{ind}_5 6 = 3$.

Problem B. Write a computer program to construct a table of indices modulo a particular primitive root of an integer.

Test. The table of indices modulo 23 with respect to the primitive root 5 includes: $\mathrm{ind}_5 1 = 22$, $\mathrm{ind}_5 2 = 2$,...$\mathrm{ind}_5 7 = 19$,....$\mathrm{ind}_5 22 = 11$.

Readers are invited to submit their attempts on problems A(i) and (ii) and B to: Mike Mudge, C/- *APC*, 2nd Floor, 215 Clarence St, Sydney 2000.

Submissions, which must reach me by 1 May, will be judged using suitably vague criteria. A prize will be awarded for the best entry received.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

A triad of curiosities — September review

(1) Powers of 10 that can be factorised in a manner which contains no zeros: 10^{18} and the example of 10^{33} quoted are the only known examples below 10^{5000} and greater than 10^{10}, below which several trivial cases occur.

(2) The digit patterns in 2^n can be readily examined to show for example that the tens digits appear periodically as do the hundreds digits and so on — the period is always $4 \times 5^{n-1}$ where n is the position of the digit counting from the right. Despite this periodicity is has been proved that there exist arbitrary length strings of zeros. However, no string of nine zeros has been found up to 2^{60000}. More work is needed . . .

For further discussion of these matters and of (3) the reader is referred to *Excursions in Number Thoery* by Ogilvy and Anderson, and encouraged to experiment further, preferably in a strictly interactive mode on a PC with the consequence of multiplying a number by its 'reverse'.

No submission worthy of a prize was received; however, a piece of work relating to the determination of Palindromic Primes has come to the surface. Using an Olivetti M20 running PCOS-Basic generating and storing 249400 primes, a sieve approach to a linear array of 150000 bits representing 150000 contiguous integers, and storing the primes themselves 100 7-digit numbers in 107 bytes of random access file. This work, by Russell Lavelle-Langham is worthy of a suitable reward as the approach should encourage many other readers.

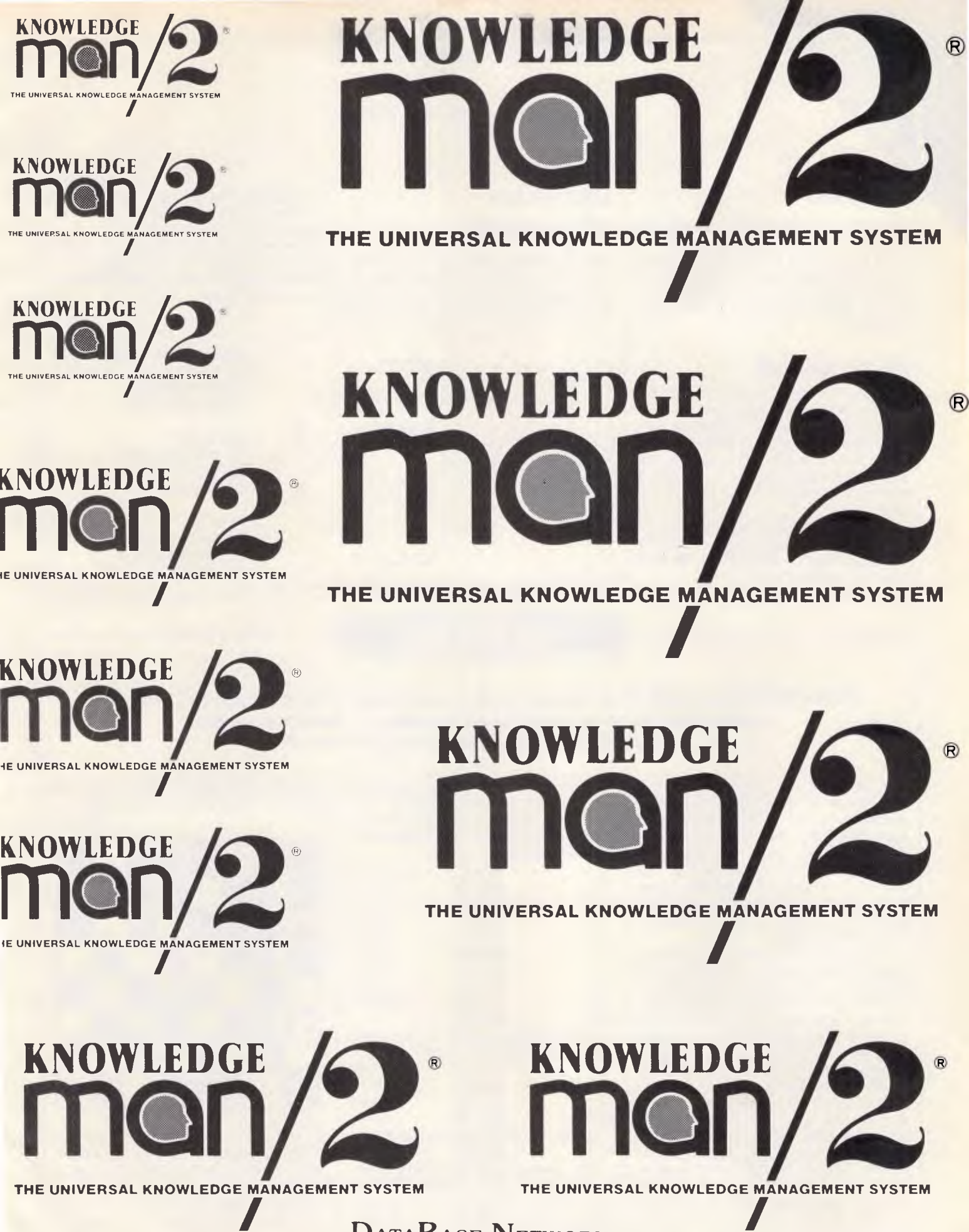
USER GROUPS UPDATE

Below is a list of updates and additions to the full User Group Index published in the January issue of APC. The next full listing will appear in the May issue of APC.

The Campbelltown User Group has recently been formed catering for most popular micros. For more details contact Ernest P Leseberg, 75 Lithgow Street, Campbelltown NSW 2560.

The Bundaberg Commodore Computer User Group meets on the 1st Sunday of each month from 10am to 4pm at the West State School Library, Steffensen Street, Bundaberg. For more details telephone (071) 72 7098 or (071) 79 2426.

The Illawarra IBM PC Club caters for all IBMs and compatibles. For more details contact the Secretary, Illawarra IBM PC Club, C/- John Lysaght (Aust) Ltd., Delivery code 29, P.O. Box 77, Port Kembla NSW 2505. Telephone (042) 75 6721.



LAZING AROUND

Brain-teasers from J J Clessa

Quickie

No prizes for this one — no answers either.

If I spent half of the money in my pocket and then gave away three quarters of what was left, I'd finish up with exactly $1.25. How much have I got at the moment?

Prize puzzle

And now for something completely different. Here is a honeycomb cross number puzzle. You must put a digit into each cell so that the clues are satisfied in each of the three directions. For example, the two-digit number read from cell A in a NW to SE direction must be a product of two primes.

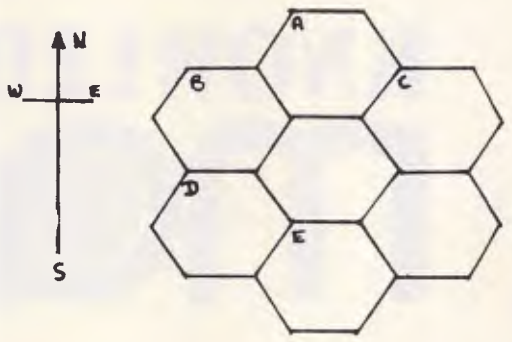
Answers, on postcards please, or backs of envelopes, to reach *APC*, 215 Clarence Street, Sydney 2000, not later than 20 March, 1986.

December prize puzzle

Many of you didn't read the question correctly. The correct solution was that there were 1,506,099,672. We would have accepted answers greater than this — of which there are probably an infinite number — but we couldn't accept the possible lower answer of 9702.

The winning entry this month came from A. Thomas of Lindisfarne, Tasmania. Congratulations, your prize will be with you shortly.

END



CLUES: (NW to SE)
(A) Product of two primes
(B) Perfect square
(C) Prime number

(SW to NE)
(B) Prime number
(D) Perfect square
(E) Prime number

(N to S)
(A) Perfect square
(B) Prime number
(C) Perfect square

MICROCHESS

Kevin O'Connell feels threatened by the realisation that a computer program understands chess better than he does — here his partner, David Levy, is running scared of Hitech.

Last month I gave the results of the 16th North American Computer Chess Championship; now, I'm going to show you a scary game. In it, the winner of the tournament, Hitech, beats the runner-up, Bebe. So what is scary about that? For the first time in my life, I feel that a computer program may have understood a position better than I do and played it better than I could!

I am not the only one who is running scared of the Hitech program (and the hardware — 64 custom chips each of 15,000 gates). My partner, David Levy, won in 1978 the famous bet he had made 10 years earlier that no computer program would beat him in a match. Following his victory over CHESS 4.7 in 1978, he renewed his bet.

Over lunch in Denver with Hans Berliner, the principal behind Hitech, it was agreed that a match between David and Hitech would be a great idea. Dr Berliner, World Champion of Correspondence Chess in 1968, regaled us with Hitech's feats over the previous few months, and by the time we reached dessert, David was visibly concerned that he might have to put pen to paper (his cheque book!) in the near future.

White: Bebe. Black: Hitech. Opening: Spanish Opening.

1	e2-e4	e7-e5
2	Ng1-f3	Nb8-c6
3	Bf1-b5	a7-a6
4	Bb5-a4	Ng8-f6
5	0-0	b7-b5
6	Ba4-b3	Bc8-b7
7	Rf1-e1	Bf8-c5
8	c2-c3	d7-d6
9	d2-d4	Bc5-b6
10	a2-a4?!	

(This is a little doubtful. 10 Bc1-g5 is currently regarded as best for White.)

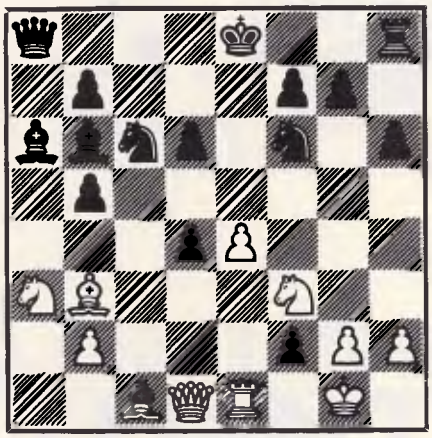
10	...	h7-h6
11	a4xb5	a6xb5
12	Ra1xa8	Qd8xa8
13	Nb1-a3	e5xd4!

(So far, so much book knowledge.)

14	c3xd4	

(This seems to be new. What was previously known was 14 Na3xb5 0-0 15 Nb5xd4 (or 15 c3xd4 Nc6-a5 with the better game for Black) 15 . . . Nc6xd4 16 Nf3xd4 Bb7xe4 with a level game, as in Kostro-Tseshkovsky, Varna 1969.

14	...	Bb7-a6



Chessboard 1

(At this point the Tournament Director, Mike Valvo, exclaimed that this was a dreadful move and that if Black was reduced to this, he must be in trouble. Now Mike, an International Master, is

COMMODORE HEAVEN

No games but everything else stocked at discount prices. We directly import hundreds of items and also deal with all the usual warehouses. Let us show you how your Commodore can become a powerful business machine.

We stock hundreds of lines most dealers have never heard of, including 15 or so word processors, 20 or more spreadsheets and databases and about the same number of accounting systems but can only list some here. Visit our new 2,000 square feet showrooms in Sydney or Melbourne to see the full range.

BUSINESS & ACCOUNTING

TOTL BUSINESS ..... D$159
Lightning fast machine language version (new in July 1984) includes stock control and printing of invoices and aged statements. Dates, postcodes, etc selectable for Australia or US. All programs now load from a master menu. Balance-forward system. Invoices allow both taxable andnon-taxable items and screen prompts and printed output headings can be customized to fit any business. This and an MSD or Commander disk drive make your 64 one of the most powerful business machines available. RUN magazine rates it a Best Buy and the US Commodore Users Group has added this enhanced version to their Approved list. People have bought the 64 just to use this program.
CASHBOX 64 ..... $D129
CASH REGISTER PROGRAM:
HOME MANAGER ..... D$37
TIME & MONEY MANAGER $69
EASYMAIL ..... D$69
PERSONAL PORTFOLIO MANAGER $79
CHARTIST STOCKS & SHARES ..... D$149
PERSONAL ACCOUNTANT ..... D$34
64 ACCOUNTING $125
Will do all the books of a business, produces trial balance profit and loss and balance sheet and prints reports, invoices and statements. By using Profit Centres for different accounts, you can obtain separate financial reports for each department and also combine these into a single report. Up to 10 chequebooks may be used concurrently and each transaction can be split across 20 categories. It does not have Accounts Receivable nor Accounts Payable open files and therefore cannot age statement balances but if the receipt field is left blank, the balance can be considered outstanding. Will prinnt detailed or summary Trial Balances and other financial statements at any time for any period. Excellent review in COMPUTE!'s Gazette (November 1984, page 113).
GENERAL LEDGER $99
MAIL LIST & LABELS $49
DATABASE $99
WORD PROCESSING $59
SPELL CHECKER $45
INTEGRATED WORD & DATA MANAGEMENT $99
KEYWORD CROSS REFERENCE $45
TIME MANAGEMENT $29
CODEWRITER Ready-To-Run SERIES ..... ea$49
Small business inventory, retail invoices, salesmen's expenses, accounts payable, accounts receivable, library, appointment planner, bill busters, coin collector, school reports.
DIALOG BUSINESS SOFTWARE ..... eaD$45
Stock aid, transact, invostat, home accounts.
ELECTRONIC HOME SERIES ..... D$24 T$12
Budget, diary, letter writer, expense manager, bill payer, bank manager.
64 ACCOUNTING ..... D$139
HOME PAK ..... D$59
3 programs in 1. Word Processor, Terminal, Filing Programs.

SPREADSHEETS/DATABASE

POWER PLAN SPREADSHEET $75
MAGPIE 64 ..... D$199
SWIFTCALC w/- SIDEWAYS ..... D$99
MULTIPLAN ..... D$139
COMMODORE'S CALC RESULT ..... D$89
CALC RESULT ADVANCED ..... D$149
PRACTICALC ..... D$49, T$25
INSTANT RECALL ..... D$65
COMMODORE DIARY ..... D$49
BUSICALC 3 ..... D$99
BUSICALC 2 ..... D$75
BUSICALC 1 ..... D$59
SUPERBASE 64/PLUS 4 ..... D$99
SUPERBASE STEPPING STONES ..... eaD$25
Purchases, day book, stock records, estate agent, travel agent, solicitor time record, accountant time record, club membership.
SUPERBASE 64 V2.0 ..... D$99

WORD PROCESSORS

TOTL WRITER $99
The latest full feature word processor including spell checker and database.
TOTL TEXT ..... D$59
Automatically inserts up to 14 lines of footnotes at the bottom of each page, which makes it popular with academics. All the usual features, such as headers, footers, page numbering, block move and delete. The last file you've replaced with an update stays on the disk in case you've made an error. We've used this and its predecessor happily for more than a year. RUN magazine (January 1984) compared the previous version very favorably with more than a dozen others. This is even better
VIZAWRITE ..... D$89
CUT & PASTE ..... D$49
FLEET SYSTEM 2 ..... D$139
OMNIWRITER & SPELLER ..... D$99
EASY SCRIPT $69
INSTAWRITER ..... D$45
SOFT SMITH ..... D$49
HES WRITER 64 ..... Cart $55
QUICK BROWN FOX ..... D$89 Cart $99
WORDCRAFT ..... Cart$99
MIRAGE PROFESSIONAL W/P $99
TEXT-PRO/DATA-PRO $49
WORD PRO 64 ..... $99
QUICK BROWN FOX $99
INSTAWRITER ..... Cartridge $39
SOFTSMITH $49
SUPER SCRIPT 64 ..... D$99

HARDWARE

1571 DRIVE $599
MOUSE FOR 64/128 ..... $149
Complete with graphics software. Printer options.
LIGHT PEN with Cad-pak software $69
SKYLES 3 SLOT CARTRIDGE EXPANDER $99
4-WAY USER PORT EXPANDER $99
VOICE MASTER Covox $75
Speech synthesiser that uses your own voice. Your 64 can sing, grunt, make animal noises or talk in any language you like. Included are programs for talking calculator and talking alarm clock.
SUPER VOICE MASTER $149
Now your 64 or 128 will do what you tell it! All of the above PLUS Word Recognition (your 64 responds to your spoken commands) and Voice Harp.
CURRAH SPEECH 64, two tones $69
FLASH! w/- switchband $185
FLASH! 64 model $125
1541 COOLING FAN $59
NUMERIC KEYPAD 64/VIC-20 ..... $99
OLYMPIA PRINTER ..... New low price
160 cps, NLQ, H. tops
RITEMAN SUPER C PRINTERS $499
105 cps dot matrix. Prints without bending the paper so even thick card can be used. Full graphics, Commodore interface included. Complete with stand to allow paper to be stacked.
DOT MATRIX PRINTER LISTER $199
SMITH CORONA daisy wheel printer $495
Printer INTERFACES . . . 12 different from $49
18K PRINTER/BUFFER for Centronics ..... D $59
Uses the hidden memory of your C64 or C128. Includes program to interface from the User Port.
PRINTMASTER/W + G graphics i/face $99
RS232 DE LUXE INTERFACE $99
C64 MOTHERBOARD (w/reset, 3-way) $85
2-IN-ONE MONITOR CABLE for128 ..... $59
CASSETTE INTERFACE and DUPLICATOR $79
DATASETTE WITH DUPLICATOR $79
Faithfully reproduces an archive copy of any Tape Program.
PAGEMATE Text holder $39
DISKETTE SAFE, lockable 100 capacity $29
COMPUTER MAINTENANCE KIT $29
FERNSPRECHER 35 Auto Modem $299
Auto-answer, Viatel, CCITT and Bell. Complete with software for C64 (RS232 i/face needed for other computers). Telecom Approved. This and the 1.1 meg drive is the basis for a BBS.
FERNSPRECHER 30 with auto dial $250
TAIHAHO MODEM $199
Auto Dial & Answer. 300 Baud. Free VIP Term Program.
TELEDATA (Handic) ..... Cart$89
TEMPERATURE PROBE $45
0-100C with Software. Great for experiments.
LIGHT SENSITIVE PROBE $39
Turn your lights on automatically with your computer.
COMPUTER SWITCH $175
Control mains operated equipment. 240V 10A. Capacity approved.
8-CHANNEL 8-BIT $99
A to D converter. Up to 4000 conversions per sec.
VIC-REL $75
Computer controlled relays. 6 output and 2 input circuits. Great for a burglar alarm.
COMPUCOVER Plastic, hinged $29
MAINTENANCE KIT $29
Screen cleaner and cloth. Head cleaner and instructions.
HEAD ALIGNMENT KIT $25
Fix your own Datasette. All tools supplied.
64K MEMORY EXPANSION $299
Gives 65536 extra bytes segmented memory in the 8K from $8000 to $9FFF. Complete with instructions on how to load eight different 8K programs into the computer's memory at once. Really shines when running assembly language. Ramdisk program (included) turns it into a solid-state disk drive, loading 24K in ONE SECOND! On VIC-20, it includes three 8K blocks for 1, 2 and 3 plus another 40K that can be paged in and out of Block 3.

DISK DRIVES

1571 COMMODORE DRIVE $599
MSD DUAL DISK DRIVE ..... Demo models $995
240 Volt, US made. All metal, with one parallel and two serial ports and 6511Q microprocessor with 16K ROM and 6K RAM. Serial interface cable included, but also has parallel port. VIC-20, 64 and 128 read/write compatible and also read compatible with the big Commodore business machines. Formats disks in seconds and duplicates in a minute or so.
COMMODORE 1 MEG DRIVE $399
TAIHAHO Commodore/Apple DRIVES $395
Top quality all-metal drives that will run BOTH Apple and Commodore disks. Complete with all plugs and 20-line parallel cables to connect to all plugs to your C64 or C128. Switches to let you choose Device No. 8 or 9 and Normal, Write Protect or Override Write Protect. Single drive expandable to double with additional drive. Regulated 240 volt 50Hz power supply.

PUBLICATIONS

ARGUS TAPE COMPUTING MAGAZINES ..... ea$10
(or $50 for one year's subscription of 6 issues of any title) Every issue has games, utilities, etc. on tape, unprotected so can get inside them to see how they work. Titles are 64 TAPE COMPUTING, VICTAPE COMPUTING, ATARI COMPUTING, SPECTRUM COMPUTING and MODEL B COMPUTING. We get them by air so December issues are now available months ahead of your local newsagent's delivery and at a price a lot less than what he charges.
COMPUTER MAGAZINES ..... ea$7
Amiga World, Run, Compute!'s & Gazette, Antic, Analog and many more. DELIVERED BY AIRMAIL MONTHS AHEAD OF THE NEWSAGENT.

INTERFACES

DAMS IEEE INTERFACE $218
PET • IEEE CABLE $69
FLASH with ON/OFF switch $175
FLASH! Standard version $125
FLASH SX64 version $175
FLASH! for 128 ..... $199

UTILITIES

MASTER 64 ..... D$99
The ultimate professional software development package. Adds almost 100 commands to the 64. Programs developed with it can be distributed with the runtime package free of royalties.
ABACUS BASIC COMPILER C64 ..... $99
BASIC Compiler. High speed P-Code small P-code execution, runtime routines (6K bytes) are only added to the starting program thus saving disk space, extensions to standard BASIC can be used in compiled programs,. program overlays possible, variables can be passed between chained programs and compiled programs can be protected. Calling programs can be longer or shorter than the called program.
PETSPEED 64 ..... D$99
Commodore's own Basic compiler that is a powerful optimizer. Old but still popular.
EPYX FAST LOAD ..... C$45
DESIGNER PENCIL ..... D$59
PAINT BRUSH ..... D$49
SYNTHY 64 ..... D$45
SYNTHY COMPANION ALBUM ..... D$19
ASSEMBLEY LANGUAGE COURSE ..... D$45
MACHINE CODE TUTOR ..... D$49
COMPUTER MAINTENANCE KIT ..... D$29
ISEPIC D129
X-REF 64 ..... D$45
TURBO BASIC ..... T$49
TURBO 64 ..... D$45
TURBO 64 UTILITIES ..... D$25
COCKROACH TURBO ROM 64 ..... $45
COCKROACH TURBO ROM 128 ..... $45
MACHINE LIGHTNING including basic lightning $99
TOOLBOX 64 includes Power 64 & PAL 64 ..... D$139
SPEED BASIC ..... D/T$25
NEWSROOM ..... D$75
Designed to print and produce a newsletter for your class or club. Over 600 pictures.
CLIP ART COLLECTION ..... D$39
For use with Newsroom. 600 more pieces of Art.
PRINT SHOP ..... D$65
PRINT SHOP GRAPHIC LIBRARIES 1,2, or 3 ..... $45
DESIGNER'S PENCIL ..... Cart,D$59
PAINT BRUSH ..... D$49
KWIK-DRAW ..... D$49
MIND PROBER $49
MIND OVER MINORS ..... Parents$59
SKY TRAVEL ..... D$85
Best astronomy program available. Find Halleys Comet with it! Gives you features of each star and planet.
PRINTER GRAPHICS UTILITY ..... D/T$25
MUSIC STUDIO ..... D$59
The best music creation program available.
64 DOCTOR ..... Disk $49, Tape $45
1541 PHYSICAL EXAM $85
1541 DISK ALIGNMENT KIT $59
2 Books, 2 Disks (Program Plus Sign Alignment) and Track Signal Detector allows you to do all routine maintenance on your 1541.
C64-C128 LIGHT PENS $59
Complete with Software to draw, play games, fill in 16 colours and Save and Load.
DOODLE! ..... D$89
Most advanced graphics package around.
CHART PAK ..... D$99
Design circuit, houses, gardens. Anything.
FLOW CHARTER ..... D$69
Produces Flow Charts after you have finished your program!
THE FINAL CARTRIDGE $159
Includes: Monitor, disk & tape, turbo, hires dump, printer interface, 24K extra RAM, BASIC 4.0, BASIC toolkit, reset keyboard utilities, programmable function keys.
MICRO-PROLOG 64 A1 ..... $275
Directly addresses screen graphics. Includes a prolog editor. New for the C64, this key artificial language has proved its worth in broadening the application of logical analysis.
CODE-PRO 64 ..... $89
OXFORD PASCAL (new edition) $119
BASIC PROGRAMMING $25
FORTH 64 Commodore $89
FORTH (Abacus) $89
SUPER C (ABACUS) ..... D$175
C POWER (532 page manual, D) $199
Z-80 CARTRIDGE $45
ZOOM! $49
Machine language monitor, assembler, DOS.
HESMON ..... Cart$69
BLITZ Compiler ..... D$99
PETSPEED $99
COMAL .14 Tutorial $19
MAE 64 ..... D$75
Maco Assembler/Text Editor that features a word processor, scrolling package, IEEE driver and a powerful machine language monitor. The ultimate professional software development package.

IMPORTANT: In accordance with the custom of the industry, hardware might be exchanged but software is NOT returnable, except for replacement with the same title, if faulty. Some disk software may self-destruct if any attempt is made to copy the program and NO refund or replacement will be considered in those circumstances.
Freight, packing, etc is charged at a flat $3 per order, irrespective of weight, items or destination.

EDUCATIONAL

STARTER KIT for programmers ..... Disk $25
10 Great programs, including word processor, mailing list, basic programming primer, 6502 intro, sound and sprites.
TRAINING KIT Disk/Worksheet $29
How to get the most from your keyboard, how to use your disk drive effectively, how to write yur first BASIC program.
32 PROGRAMS ..... Disk&Book $25
The book alone retails for $29.95! 32 useful programs already on disk to save you the chore of punching them in. Book also gives you exercises in how to change them. A vital follow on to the above or to Commodore's Introduction to Basic.
ALL THREE OF THE ABOVE $69
INTRODUCTION TO BASIC ..... ea$29
Commodore's famous course that assumes no prior knowledge and takes you step by step through programming. Each Part contains 2 cassettes of programs and a comprehensive manual.
MATHS, O LEVEL ..... T$19
PHYSICS, O LEVEL ..... T$19
GERMAN MASTER, A, O LEVELS ..... T$19
FRENCH MISTRESS, A, O LEVELS ..... T$19
COMPUTER STUDIES ..... T$19
COMMODORE'S INTRO TO BASIC $29
HAN-ZON SERIES:
Beat The Bomb, Keyboard Skills, Super Drag ..... D ea$19
Spelling, Treasure ..... D ea$25
Tell Talas ..... D$39
DR WATSON ASSEMBLY LANGUAGE TUTOR ..... T$45
IDN TYPING TUTOR $25
IDN EDUCATION II ..... D$75
IVAN BERG EDUCATIONAL $29
Tapes and Students' Notes. Commodore's newest. Titles come and go quickly. In stock today are German, Computer Studies, French, Maths, Physics and Geography at British. O and A levels.
EDUCATIONAL TAPES ..... ea$15
or all 18 for $200. Written by Australian teachers conforming to Victorian curriculum. Young Maths, Multiplication, Add & Subtract (2 Tapes), Division, Multiplication, Shipmaths, Race To The Moon, Invadergraph, Swerve Maths, Supermind, Spellstart (4 Tapes), Rocket Spell, Anagram Fun and, Word File Maker.

SPECIAL INTERESTS

664-NAME GENEALOGICAL PROGRAM ..... D$85
Produces 4, 5, or 6 generation family record charts to the printer or 4-generation charts to the screen. Fully indexed and with easy screen editing, 864 names, plus notes on each person, fit on each disk and several disks may be used.
ANIMAL PEDIGREE PROGRAM ..... D$135
Produces 4 or 5 generation pedigree charts, ownership, mating, breeding, shows and award records with full indexing and easy screen editing. Search function allows easy access (IBM and Apple versions available soon).
TATTS 45 PROGRAM Just Issued $85
ASTROLOGY PROGRAM $85
(Also for Apple II + and IBM Pc). Based on program used world-wide by professional astrolgers. Provides individual horoscopes for all times and places. Much deeper than the pop-style sun astrology you see in magazines. Basically geocentric but heliocentric is possible. Koch system of Houses and Tropical Zodiac but Western Sidential is an option. Student guide lets you ask the computer questions like: What does a Gemini rising sign mean?

128 PROGRAMS IN STOCK

1571 DRIVE $599
TURBO-ROM 128 ..... $45
BASIC COMPILER 128 ..... $125
CONSULTANT (Data Management) $189
WORD PRO 128 ..... $189
PAPERCLIP (Word Processor) $199
DATA MANAGER 128 w/- Report Writer $139
SWIFTCALC SIDEWAYS $139
SWIFTCALC W/SIDEWAYS $149
JANE $85
WORDWRITER $139
FINANCIAL TIME MACHINE $119
HALLEY PROJECT ..... D$69
SIDEWAYS $59
SUPERSCRIPT 128 ..... D$149
SUPERBASE 128 V2.0 ..... D$149

ST PROGRAMS IN STOCK

DISK DOCTOR $65
OBJECT EDITOR $59
MAPS AND LEGENDS $69
2-KEY ACCOUNTING $99
HOME PLANETARIUM $59
CP/M EMULATOR $99
VIP PROFESSIONAL $250
PRO BUSINESS LETTER $75
HOMEWORK HELPER $69
FINAL WORLD $175
RAM DISKS $65
SOFT SPOOL $59
MICHTRON UTILITIES $49
M-COPY $125
M-DUPE $49
DEGAS $69
ZOOMRACHS $89
RHYTHM $89
HIPPO-C COMPILER $95
MACRO ASSEMBLER $149
META PASCAL $249
LATTICE C $275

PLUS: 200 OTHER PROGRAMS AND MORE POURING IN ™ ATARI

AMIGA ™

The Creative Edge now at new low prices

3 YEAR WARRANTY AVAILABLE

1040 - ST INSTOCK BY MARCH

Power without the price **520-ST***

* We can supply Amiga and Atari and all available accessories from our local stock or you may buy it at US prices by sending payment to CHAMBERS COMPUTER SUPPLIES in California and arrange your own shipping, customs clearance, duty and sales tax payment. Direct shipments do NOT get free service in Australia.

CHAMBERS COMPUTER SUPPLIES

2nd Floor, Curtin House, 252 Swanston Street, MELBOURNE 3001 (03) 663 4441
1st Floor, Crest Hotel, 111 Darlinghurst Rd, KINGS CROSS 2011 (02) 356 3155
(Directly above Kings Cross Railway Station and Crest covered car park)

WE LOVE MAIL ORDERS

VISA • MASTERCARD BANCARD WELCOME
ALL ORDERS ARE SHIPPED WITHIN 24 HOURS
FOR ITEMS CURRENTLY IN STOCK. POSTAGE & PACKING $3 PER ORDER ANYWHERE IN AUSTRALIA.

TO ORDER PHONE
MELB. (03) 663 4441
SYDNEY (02) 356 3155

THE BIGGEST RANGE OF SOFTWARE AND ACCESSORIES IN AUSTRALIA

We import directly hundreds of lines unique to us. Drop in and check our huge range

MICROCHESS

not only a very strong player, he has also been present at many computer chess tournaments and should, by now, know better. David Ievy's instant response was to offer a small wager that Black would win. Valvo hesitated and then made the mistake of asking what stake David had in mind. The suggestion was that one dollar be risked but Mike declined.)

15 e4-35

(To break open the centre against Black's king. It seems this must be the right move, but it goes nowhere.)

15 ... d6xe5

(My partner is very persistent and has a family to support, so he now suggests 50 cents, but Mike was still determined to hang on to his money.)

16 d4xe5

(16 Nf3xe5 0-0 leaves the black king safe and White having to worry about a weak d-pawn.)

16 ... Nf6-g4

17 Bb3xf7+?

(It seems that Black is in a lot of trouble, but it turns out to be more apparent than real, so this move must be dubious at best.)

17 ... Ke8-e7

(Not 17 ... Ke8xf7 18 Qd1-d7+ and after 19 Qd7xg4, White would have an extra pawn and a winning position.

Now this is the critical position.)

18 Kg2-f1?

(18 Nf3-d4 Nc6xd4 19 Qd1xg4 Ke7xf7 20 e5-e6+ gives White a very dangerous attack for the piece, but 18 ... Bb6xd4, covering the g-pawn and permitting 20 ... Kf7-e7 in response to the above line, leaves Black winning easily.

18 Re1-e2 should have been tried, for better or worse. The complications are such that probably neither competitor could analyse this position accurately, and I might well be overlooking something as well, but here are a couple of possibilities:

(i) 18 ... b5-b4 19 Na3-c4 Rh8-d8 20 Qd1-b3 Nc6-d4! 21 Nf3xd4 Rd8xd4 22 Nc4xb6 c7xb6 23 Re2-e1, and Black's knight looks very exposed.

(ii) 18...Ng4xf2 19 Qd1-d5 Rh8-d8 20 Qd5-e6+ Ke7-f8 21 Bc1-d2 (if 21 Bc1-e3 Rd8-d1+ 22 Nf3-e1 Nc6-d4! 23 Be3xd4 Bb6xd4 24 b2-b4 Nf2-d3+ 25 Kg1-f1 Bd4-c3 26 Na3-c2 Ba6-b7 and Black should come out ahead, although the complications after 27 Bf7-g6 Bb7-d5 28 Qe6-f5+ Kf8-g8 29 e5-e6 are still enormous) 21 ... b5-b4 22 Na3-c4 Ba6xc4 23 Qe6xc4 Qa8-a1+ 24 Bd2-e1 Nf2-d3+ 25 Kg1-f1 Nd3xe1 26 Nfxe1 with level material and a wild position.

18 ... b5-b4+

19 Na3-c4 Rh8-d8

20 Qd1-c2

(Qd1-b3 is useless now since the knight is pinned.)

20 ... Ke7xf7

21 Qc2-f5+ Ng4-f6!

22 Qf5-c2

(22 e5xf6 might have been a better practical chance, but it still leaves White a piece down.)

22 ... b4-b3

23 Qc2-e2

(23 Qc2xb3? Nc6-a5.)

23 ... Nc6-d4!

24 Nf3xd4 Rd8xd4

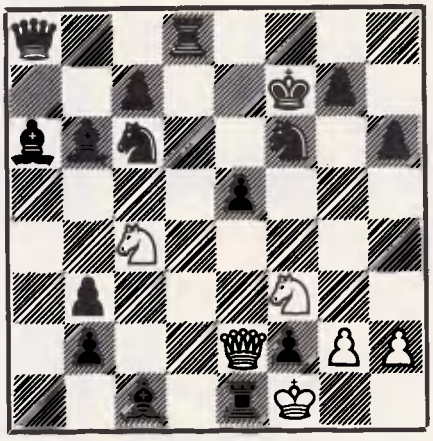
25 Kf1-g1 Ba6xc4

26 Qe2-f3 Qa8xf3

27 g2xf3 0-1

(White resigned — after 27 ... Nf6-d5, Black is simply two pieces ahead. A most impressive game.)

END



Chessboard 2

WRITING FOR APC

Your chance to contribute to the magazine.

We're offering readers the chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature, write with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well for reference.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in re-inventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is $100 per published page, and payment usually follows about eight weeks after publication.

MICRO-EDUCATIONAL

VIATEL ★49001#

40 LAMAN ST, NEWCASTLE (049) 26 4122
AUSTRALIA'S LARGEST COMPUTER MAIL-ORDER COMPANY

DISKS $2

5¼" SSDD
CONTROL DATA
OR
VERBATIM MFR

$1.80 INC TAX

($170 per 100. Tax Ex prices: $1.60 ea. $150/100)
DSDD $3.20 3½" SSDD $6 DSDD $8

Hello again,
Well, we're gearing up for massive expansion in 1986 and to start the ball rolling we've dropped disk prices to their lowest point ever at $1.80 inc tax, $1.60 ex. And to find all those Apple and IBM PC owners who aren't yet on our 20,000 plus mailing list, we're giving away free our latest public domain Library Disk. Packed with great utilities. If you've never bought anything from Micro Ed, now's your chance. Free library disks, free newsletters, Friend-of-the-family prices, overnight courier delivery, STD-FREE phone ordering, 10 day money back and 6 months serice warranties and the best people in the business to deal with. Us. What are you waiting for?

Regards

George.

OUR LOWEST PRICE EVER

On top-quality, Australian-made SSDD 5¼" CONTROL DATA or VERBATIM (Specify brand required) disks.
Suit Apple,Commodore, IBM, etc.

WHY DO WE DO IT?

We're crazy, I know. Even Dick Smith sells disks at $2.70 so why $1.80? Well I've always wanted to be the first to sell a MILLION DISKS in a year. And 1986 is the year!

OUR BEST SELLERS

SWS 60 DISK STORAGE BOX

* Holds 60 to 80 5¼" Disks
* Lockable, hinged lid
* Australian made

$22 ex **$25** inc

JOYSTICK

It's taken us 4 years to find the right joystick. This one has all the features: Robust construction, 150K linear pots, trim pots, self-centring, self-centring defeat on positive and negative X-Y axes using 4 switches, IBM/APPLE switchable, 4 fire buttons for L-R hand use, excellent stability etc.

Apple IIe/IIc $45
Apple II+/IBM PC $50

MAINS LINE FILTER

	ex	inc
3A	110	120
6A	120	130
10A	130	140

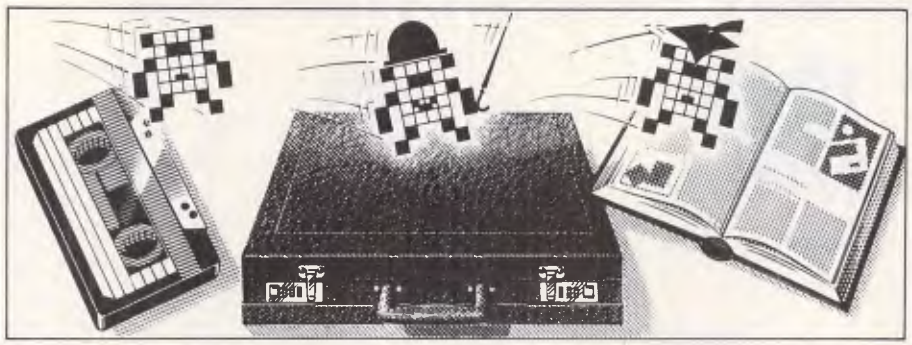
This is the filter we use ourselves to keep the PC and ACT hard disk happy. We've tried most of the others and this is the best (It's a bit dearer but a **lot** better)

$345

SUPER 5 ENP 1090 PRINTER

SUPER 5 SLIMLINE DRIVE

PROGRAM FILE



- *Games*
- *Scientific/mathematic*
- *Business*
- *Toolkit/utilities*
- *Educational/Computer Aided Learning*

Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

This is the first outing of the updated and improved Program File. It replaces the old-format Programs section and TJ's Workshop, but all material which used to go into TJ's Workshop and Programs will continue to appear in the new version. In addition, the Program of the Month is now accompanied by a short feature giving some background to the program. I hope that you will find the changes a great improvement. Please let me know what you think, and also feel free to comment on any of the programs that we publish. It is always good to hear your views and it will help us to improve Program File.

This time, Program of the Month is an expert system written in Microsoft Basic for the IBM PC, but it shouldn't be too hard to convert it to other disk-based machines. Mark Needham, the author, has written some background to the program which is given prior to the listing. The program is split into two modules to allow you to set up your own rules, compile and then run them. The system can be queried to demonstrate how it arrives at a conclusion.

For the Commodore 64 there is a program, which could be adapted in principle for other machines, to use a speech synthesiser to speak out loud all keyboard input to the machine. This was written to help a blind person with computer programming and should be used in conjunction with a Currah speech synthesiser. It should, with some work, be possible to adapt the system to other computers and speech synthesisers, helping to give as wide a range of people as possible access to the information revolution.

For Spectrum owners we publish a very bright and attractive program that produces amazing designs and patterns. And for Amstrad owners and Pascal users, there is a graphics library program that provides a comprehensive library of plotting routines to produce high-quality diagrams and graphs.

Music lovers who happen to be Commodore owners can try out the Polysynth program. I received three different synthesiser programs for the Commodore 64 this month and I feel that this is the best of them. It allows three notes to be played at once, and has several pre-programmed sounds as well as the ability to program your own.

For Apple IIc and IIe owners there's a useful set of utilities written in Basic. On a lighter note 'Frog' for the VZ-200 captures the difficulty of surviving in a pond; and IBM PC owners who use Pascal can now load DOS directories into their programs courtesy of an unknown author.

Finally, Kevin Riordan discourses on the relative merits of sorting methods providing an assembly code listing for users of the 6502 microprocessor (and a Basic data statement listing for Commodore 64 users).

While continuing to publish our unique and useful blend of programs and routines every month, I would like to see some improvement in the quality of documentation and commenting of programs. It would also be useful to have programs that can run with a minimum of conversion on the maximum number of machines. So, please send in useful routines that can easily be incorporated into other peoples' programs. All such routines must be carefully explained with comments in the routines and external documentation. A good subject to start with might be text input, output and formatting. The best, if good enough, will make it into Program File as soon as possible.

We would still like to receive the usual haphazard assortment of tips which normally arrive on the *APC* doormat each month, so keep sending them in. Incidentally, for those interested, TJ stands for Terminal Junkie, or originally did.

Back to the Program of the Month: expert systems have been around for a few years now and are no longer the leading edge of AI research. Several flexible expert systems are commercially available which have met with considerable success. Expert systems generally provide a set of rules, produced by an expert in that particular field and use these as a basis for a question-and-answer session. These two things combined produce a piece of advice on the situation which the system is being consulted about. Obviously, an expert system can only be as good as the expert who feeds in the original information, but for many purposes this can be more than good enough. There are many possible fields in which expert systems may be used, including aids to medical diagnosis and advice on keeping soil fertile.

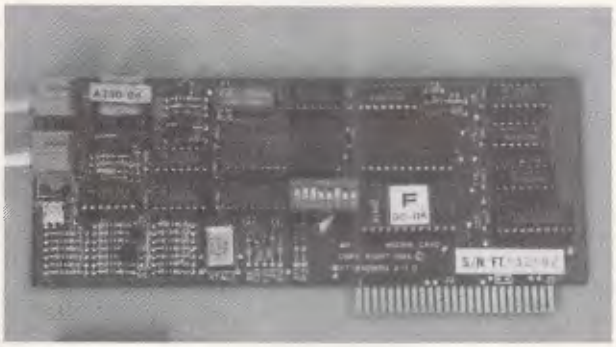
One of the important features of expert systems is that they can be asked to show how they arrived at a conclusion. They then provide a breakdown of the answers to the questions and the rules that led them to their conclusion. Many, especially this one, do not do this

MICRO-EDUCATIONAL PTY LTD

40 LAMAN ST, NEWCASTLE (049) 26 4122
AUSTRALIA'S LARGEST COMPUTER MAIL-ORDER COMPANY

DO SOMETHING USEFUL WITH YOUR APPLE II+ or IIe

$250



ASK FOR OUR FREE 1986 CATALOG

COMMUNICATE with Micro-Ed VIATEL Apple Modem

Without a modem your Apple is a two-dimensional toy. Loads of potential but it always stops there. Add a modem and you give it a window to the world that lets it realise its potential power.

And it's all there waiting for you. While you've been busy battling with the intricacies of AppleWorks, VISICALC, PrintShop and Raster Blaster, the world of computer communications has been quietly flowering, just waiting for you to discover it.

And hasn't it grown! VIATEL, MIDAS, BULLETIN BOARDS, LEXIS, MEDLARS, etc, etc. You can discover it yourself with a modem. Go on. Off you go. Borrow someone's modem and try these what-to-do's for starters:

— Ring up VIATEL and find out what's happening in the world.
— Monitor stock price fluctuations as they occur.
— Buy and sell just about anything without leaving home.
— Send text and typeset copy over the phone lines anywhere in the world.
— Conduct all your banking transactions from home.
— Chat with other micros and bulletin boards.
— Chat with mighty mainframes.
— Send and receive electronic mail, telexes and facsimiles.
— Order your groceries.
— Check airline schedules and book theatre tickets.
— Interrogate massive professional and commercial databases worldwide. etc etc etc. Fascinating stuff and great fun.

And it's EASY! With a direct-connect modem the computer does the hack work for you. No more hand-dialling or checking for busy tones. The computer does all that. All you do is use it. Now, this is revolutionary. Imagine leaving your Apple set up as an intelligent telex, buying and selling commodities automatically as the price fluctuates ... Get the idea? Even if your Apple has been gathering dust in a cupboard you'll want to dust it off for modem communication.

HOW MUCH DOES IT COST? If you're a confirmed masochist you'll go off to Apple and buy their modem for $800. Or compromise with a $500 serial card combination. But there is a cheaper alternative. The Micro-Ed Direct-Connect Apple Modem for $250 inc tax. (*Not yet Telecom approved*).

This is our own card modem which we set out to build in Australia, with a minimum of middlemen, high-volume sales and all the features of an $800 modem for $250. And we did it.

Look at its features:

— Auto-dial, auto-answer, auto-disconnect. Hayes micromodem compatible.
— 300 Bd full-duplex, 1200 Bd half-duplex, 1200/75 Bd VIATEL mode.
— FUll suite of VIATEL and comms software provided on disk.
— Australian designed, manufactured and supported.

It's new. You can only get it from us. It's cheap, available and it works. We give you the security of a 10-day no-questions-asked money-back warranty and 6 months full service warranty, as well as the security of dealing with Australia's largest computer mail-order company. Us. We also give you all the necessary VIATEL and MIDAS application forms and information, and just because we like you, we'll include our free Library Disk #4 which is full of useful communication utilities.

So there it is. Well, what are you waiting for? Go forth and introduce your Apple to the world. Order your Micro-Ed Modem now on (049) 26 4122, or send your cheque for $255 ($5 courier).
Tax ex price $225.

But do it NOW
before the world passes you by.

Order NOW on

(049) 26 4122

Dear George, Please rush me the following by overnight courier

_____ $_____
_____ $_____
_____ $_____

+FREE library disk for my APPLE/IBM (orders over $50)

Courier ($5/$10) $_____

TOTAL _____

Enclosed please find cheque/purchase order/postal order/Bankcard/Mastercard/Visa

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ for $_____

Name _____

Address _____

Postcode Computer Brand _____

intelligently or with direction, but a fully-fledged expert system would be able to provide a very precise part of the explanation and intelligently guess what you wanted to query.

This expert system is very simple, but can be 'programmed' with complex sets of rules so that it will display a list of things which led it to its conclusion.

Program of the Month
MSBasic Simple Expert System

by Mark Needham

Simple Expert System will run on most micros that use the standard Microsoft Basic. It was written on an IBM Portable and runs with the Basic-A interpreter or compiled with the Microsoft compiler. The system consists of two programs, EXPCOMP and EXPRUN. EXPCOMP reads in two text files and creates a file that EXPRUN can use. The two text files define the subject that the system will be expert on, and as nothing is built into the programs, the system can be used as an expert on anything — all you have to do is create a database on the subject of your choice. The syntax of the files should be obvious from the example TRAVEL data.

More information about the syntax of the Attribute and Rule files is included in the files as comment lines.

The Attribute file holds the information about the attributes in the system. In the TRAVEL example, the main attribute is the TRAVEL attribute and the value of this attribute is the system's main goal. To obtain the value of the main attribute, it is necessary to obtain the value of other attributes. These values are obtained either by asking the user for information, or using the rules that are defined in the Rules file.

There are a couple of reasons why the system is split up into the two programs EXPCOMP and EXPRUN. The main reason is that the program would have been too large to fit in many small micros if both sections were combined, and the ability for the expert system to run on almost any machine that uses Microsoft Basic was a high priority. Another reason is that the system is easy and logical to split up, as EXPCOMP would be used to compile the data from the database, and EXPRUN would be used to actually run the system.

EXPCOMP Documentation

This program converts the two text files into data that EXPRUN can use. The arrays used can be redimensioned to cater with as many attributes or rules that you need, as long as the machine the program is running on has enough memory. The program is split up into four main routines that are called after the standard data has been set up.

(1) Get file name (line 2000): this routine obtains the names of the Attribute and Rule files from the user. It also gets the name of the output file that EXPRUN will use, and also a file name or device for a special list. The device can be PRN for the printer, CON for the screen, NUL for no list at all, or a filename for a file on disk. If you add a semicolon after a file name, the input sequence will end and the other names will be set to a default. It is best to make the start of all the filenames the same, but with different extensions. The special list will default to NUL. The filenames are checked for legal characters and the drive letter at the beginning (line 9000). The names it checks are standard MS-DOS names (you may need to change this routine if your machine uses different filename types).

(2) Read Attribute file (line 2500): this routine reads the Attribute file, checking the syntax as it goes. As attributes are read in they are stored in several arrays.

ATTR$() — holds the names of the attributes as they are defined. The name can consist of more than one word and the words do not have to be hyphenated. When the Rule file is read in, the attribute names used must have been defined in the Attribute file otherwise an error will be reported.

DESC$() — holds the description of the attribute. This is used in EXPRUN when the value of the attribute is displayed for the user.

VERB$() — holds the verb for the attribute. This is used when reading the Rule file and also when displaying the value for the user in EXPRUN. In the majority of cases it will be 'IS'.

TYPE%() — holds a code for the type of the attribute.

1 — The value can either be true or false (Boolean).

2 — The value is numeric in a given range.

3 — The value comes from a range of options (maximum 20).

If there is no ASK line defined, the value must be defined using a rule and the code will be −1, −2 or −3.

OP$() — holds the options that are defined on the OPTIONS line in the Attribute file. For Boolean, no options are required. For the numeric type, the lower and upper limits are required and also a description of the units, although the units are optional. In the TRAVEL example, the units for the DISTANCE attribute is 'miles'.

NOP%() — holds the number of the options held in the OP$() array.

ASK$() — holds the question that EXPRUN will ask the user when it requires a value for the attribute. If the ASK line is omitted, the system must be able to obtain the value of the attribute from a rule.

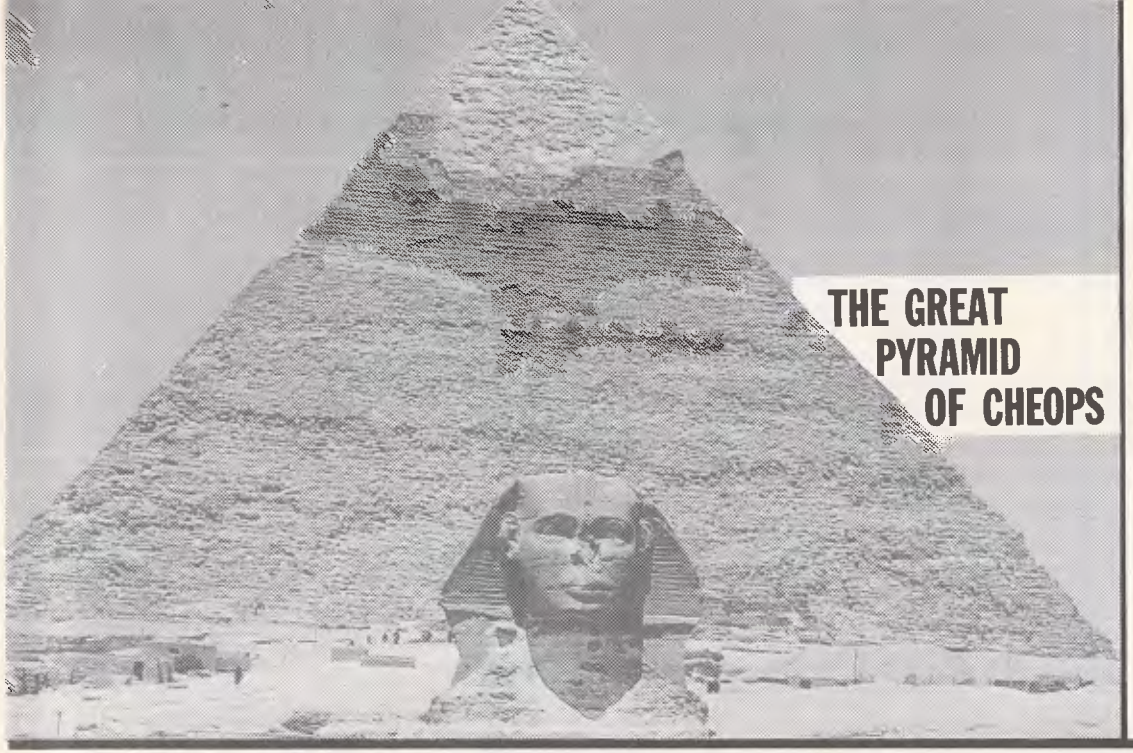
UNK%() — holds a flag that is true if the value of an attribute can be obtained by proving a rule. This allows the user to enter a question mark in EXPRUN if he does not know the answer to a question. In this case, the system will search for a rule that gives the attribute a value.

The program checks for the end of the file with the EDF() command (this command may be different on some computers or may not even exist). If you have no end-of-file detector function, insert a check for a line of text that marks the end of the file. When all attributes have been read in, the attribute names are checked for any duplication; if there is a duplication, an error is given.

All syntax errors will be displayed on the screen as they are detected. The program will stop after it has read in all of the Attribute file, if an error is found.

(3) Read Rule file (line 3000): this routine reads the Rule file, checking the syntax of the file and creating two arrays that are a compacted version of the Rule file. This compacted version is then used by EXPRUN. The two arrays are CONC%() and TEST%().

CONC%() — holds three numbers for each of the rules in the Rule file. The first line in the rule definition is the conclusion if all the conditions in that rule are true. Element 0 of the CONC%() array is used to store the number of the attribute; element 1 is the value the



MAC-XT/TURBO

BOTH DESIGNED AND CONSTRUCTED WITH ONE COMMON PURPOSE:— TO WITHSTAND THE TESTS OF TIME.

In the tradition of producing to EXACTING STANDARDS and NOT DOWN TO PRICE, the "MAC-XT/TURBO" IBM compatible computer accommodates the most fastidious and discerning buyer. At KCM we believe that only a products true quality will reflect its reliability and years of trouble free service to its owner and that price should be an important but secondary observation. If your company, or you as an individual appreciate impeccible service, true reliability and AFFORDABLE QUALITY then talk to us at KCM.

The "MAC-XT/TURBO" IBM COMPATIBLE PERSONAL COMPUTER:
4 LAYER MOTHERBOARD, 4.77 & 7.33 Mhz. Clockspeeds, 640K RAM, 2 x DSDD
"COPAL" FLOPPY DRIVES, MULTI I/O CARD, C/GRAPHICS CARD, HI-TEK KEYBOARD,
PC-DOS 3.10, 12 MONTH WARRANTY. $1,995.00
BECAUSE HI-TECHNOLOGY SHOULD GO HAND IN HAND WITH RELIABILITY

KCM COMPUTERS PTY. LTD.
MASTER HARDWARE & SOFTWARE ENGINEERS
380 Victoria St., Richmond, 3121
Telephone: (03) 429 2733 AA39766 KCM

attribute will be given if the rule is true. Element 2 is a pointer to the first element of the TEST%() array.

TEST%() — holds the conditions for the rule. Element 0 is the attribute number, element 1 is the value. The value in element 3 depends on the type of the attribute. If the attribute is Boolean, 'NOT' can be put before the value (for example, YOU CAN DRIVE IS NOT TRUE). In this case, element 3 holds −1 to indicate the 'NOT'. If the attribute type is numeric, then element 3 holds the type of comparison. (1 for <, 2 for<=, 3 for =, 4 for>=, 5 for>, and 6 for <>.) Element 2 holds 0 if it is the last in the list of conditions, 1 if there are more conditions in the list. The next condition in the list is in the following elements of the TEST%() array.

All the syntax errors will be displayed on the screen as they are detected. If an error is found, the program will stop after it has read in all of the Rule file and will not create the compacted file.

4) Save EXPRUN data (line 5000): this routine saves all the data from the aforementioned arrays, along with the number of attributes and rules defined on a compacted format. This gives EXPRUN all the information it requires.

EXPRUN Documentation

The EXPRUN program, using the data created by the EXPCOMP program, is the main part of Simple Expert System. The user is asked to identify the attribute of which a value is required. This attribute does not have to be the main attribute, as the selected attribute is put on top of a stack called the 'goal stack'. The system then checks to see if the value of the attribute can be obtained by asking the user a question. If the user supplies an answer, the attribute at the top of the goal stack is removed and the value given to it is remembered. If you want to know why the question is being asked, enter 'WHY' and the system will display the current rule it is trying to evaluate. If no question can be asked, the system searches for a rule with that attribute in the conclusion part. If no rule can be found, there can be no answer. When a rule is found, all the conditions in the rule are tested to see if they are true. If they are all true, then the attribute is given the value and the rule number is remembered. If an attribute in one of the conditions has not yet been given a value, a value must be found for it; to do this, the unknown attribute is put on top of the goal stack and the process starts all over again.

This process continues until the attribute that was initially at the top of the goal stack has been given a value.

If a part of a rule is false, then that rule is totally discarded so that the system can skip over it later on.

Like EXPCOMP, EXPRUN is split up into several main routines.

1) Read file names (line 2000): this routine is similar to the filename routine in EXPCOMP. It obtains the name of the file that EXPCOMP created, and also a name or device for a copy of the output. The devices can be PRN for printer, CON for screen, or if a name is given, the output will be sent to disk.

2) Read data file (line 3000): using the filename from the 2000 routine, this routine loads the required data. If the file is not found, a FILE NOT FOUND error will occur. This problem could have been detected using the error-trapping facilities on the IBM, but they are non-standard so I left this out. If your machine has error-trapping facilities, a file existence check would make the system more user-friendly.

3) Initialise data (line 2500): the arrays used to hold the values given to attributes, the questions which have been asked, and the rules that gave values to attributes are all cleared out.

4) Find value (line 3500): this routine continues until either a value is found for the attribute at the very top of the goal stack or no value can be found. S%() is used as the goal stack, with SPTR% as the stack pointer. Line 3600 checks to see if a question can be asked to obtain a value; QUEST%() is set to −1 if the question has already been asked. The rest of the section, 3610 — 3660, using the large routine at line 4000, gets a value from the user.

Lines 3800 — 3830 search through the rules to find a conclusion, CONC%(n,0), that is the same as the attribute on top of the goal stack. If no rule can be found, there can be no value for that attribute.

Lines 3850 — 3880 check all the conditions attached to a rule to see if they are all true. If they are, lines 3890 — 3895 give the attribute the value from CONC%(n,1), rule out the rule to save time later on, and remember the rule number. The attribute at the top is discarded, and if it is the top one, the routine ends with an answer.

When a value has been found, a menu with six options is given. Options two and three allow you to display the values of attributes and where the values came from. If you have selected an output file or device, the information will be output to the selected place as well as the screen. Both of these routines use the information set up in the Attribute file and give all answers in almost English form.

Giving answers in English is very important, as the user of the expert system may not have any knowledge of computers apart from pressing the keys. In future, expert systems will be able to talk and listen to what the user has to say. These abilities remove the problems of pressing keys and reading screens that many non-computer users complain about, and in many applications the user may be too busy to use a computer terminal anyway.

Option four on the menu allows you to select a help mode which will give information about which attributes are being searched for and what rules are being discarded as the program runs. This could be useful when testing the data you have created.

Option five allows a new database to be loaded and run without stopping the program's execution.

The layout of the menu and of the screens in general was kept simple, using only the PRINT command as I did not want to use any machine-specific commands. You may like to tidy up the search layouts using the extra screen commands that your machine may have.

Instructions for use

The Simpler Expert System consists of two programs, EXPCOMP and EXPRUN. EXPCOMP takes the source code and converts it into a form which EXPRUN can use. Both programs are written in standard Microsoft Basic and should work on most home micros without too many alterations, either compiled or interpreted. The only change that will be registered is the clear screen statement in EXPRUN at line 9100. The clear screen statement is not really necessary, and if your machine or compiler does not support it, leave it out. The only other things that may need changing are the file-handling commands, the INSTR command, and possibly the length of the variable names.

Running the system

1) Create some data for the system to use. I have included an example that works out the best method of travelling between two locations. The two data files hold the attribute information and the rule information. There could be more options than the ones given: you could add attributes for TAXI and BUS and make up some rules that give these as solutions. The data files can be created using a text editor or by putting the lines in data statements, opening a file for output and printing them to a file. LINE INPUT is required to read the text as there can be commas in the line.

2) Run EXPCOMP.

Enter the name of the Attribute file. The other filenames will be automatically set

up, so if you put a ';' after the filename, you will not be asked for the other names and the list file will be NUL. If you want a printer copy of the files as they are compiled, enter PRN for the list output or use CON for the screen. The list file will be a copy of the two data files put together.

3) If there are no errors, the program will create a 'compiled' file. It is probably best to give the files the same name but with the following file extensions (I have used TRAVEL for the demonstration data):

TRAVEL.TXT — Attribute file
TRAVEL.RUL — Rule file
TRAVEL.DAT — the compiled output used by EXPRUN

4) Run EXPRUN.

Enter the filename of the compiled output, in this case TRAVEL.DAT or just TRAVEL as the default will have .DAT on the end.

5) A list of all the attributes will appear. Enter the number of the attribute the expert system is to work out. The system will now ask questions to work out the value. In the TRAVEL example, enter 1.

6) To evaluate an attribute, the system may have to ask the user for some information. The question comes from the ASK line of the Attribute file. If you want to know why the question is being asked, enter 'WHY'. If you do not know the value you are being asked for, and the system has some other way of obtaining the information, you will be able to enter a '?'. In the example given, the weather can be obtained either by asking you directly or by finding out if the sun is shining or if it is cold.

7) Option four from the main menu sets a flag which allows you to see some of the decisions that the system is making, and what rules it is discarding.

8) If you select a list file or printer output in EXPRUN, options two and three from the main menu will output the values to the selected device as well.

```
900 REM  ************************************************************
910 REM  * Simple Expert System / Experiment in Artificial Intelligence *
920 REM  *                                                            *
930 REM  * Written by Mark Needham       EXPCOMP          November 1985 *
940 REM  ************************************************************
950 REM
960 REM  **** define the maximum number of attributes required              ****
970 REM  **** use these maximums to dimension the names arrays in EXPRUN ****
980 REM
1000 MAXATTR%=40
1010 DIM ATTR$(40),DESC$(40),VERB$(40),TYPE%(40),OP$(40,20)
1015 DIM NOP%(40),ASK$(40),UNK%(40)
1017 REM
1018 REM  **** define the maximum number of rules ****
1019 REM
1020 MAXRULE$%=100
1030 DIM CONC%(100,2)
1037 REM
1038 REM  **** define the maximum number of conditions ****
1039 REM
1040 MAXCL%=200
1050 DIM TEXT%(200.3)
1060 CHECK$=" ABCDEFGHIJKLMNOPQRSTUVWXYZ!@$%&()[]abcdefghijklmnopqrstuvwxyz'-
1070 COMMENT$="(*":BRACKBTART$="[":BRACKEND$="]":TITLE$="Expert System"
1080 TITL%=0:LC%=0
1090 BELL$=CHR$(7):REM ****  set error bell sound character ****
1200 GOSUB 1900   :REM ****  display program heading ****
1210 GOSUB 2000   :REM ****  get file names ****
1220 GOSUB 2500   :REM ****  read and check attribute file ****
1230 GOSUB 4000   :REM ****  display number of errors ****
1260 IF NUMER%<>0 THEN GOTO 1330
1270 GOSUB 3000   :REM ****  read and check rule file ****
1280 GOSUB 4030   :REM ****  display errors ****
1290 IF NUMER%<>0 THEN GOTO 1330
1320 GOSUB 5000
1330 IF LST%=2 THEN CLOSE #2
1340 END
1897 REM
1898 REM  **** display program name as a heading ****
1899 REM
1900 PRINT:PRINT "Simple Expert System COMPILER Program Version 1.0":PRINT
1910 RETURN
1970 REM
1980 REM  **** Get file names from user ****
1990 REM
2000 PRINT "Enter Attribute Definition File Name (.txt) ";
2010 A$="":INPUT A$:GOSUB 9000:GOSUB 9100
2028 IF ER% THEN GOSUB 9500:GOTO 2000
2030 IF DP%=0 THEN A$=A$+".txt":DP%=INSTR(A$.".")
2048 ATTRFILE$=A$:DEFAULT$=LEFT$(A$.DP%-1)
2045 IF SEMI% THEN A$=DEFAULT$+".rul":GOTO 2090
2050 PRINT "Enter Rule Definition File name (";DEFAULT$;".rul) ";
2060 A$="":INPUT A$:IF A$=";" THEN SEMI%=-1:A$=""
2065 IF A$="" THEN A$=DEFAULT$+".rul":GOTO 2090
2070 GOSUB 9000:GOSUB 9100:IF ER% THEN GOSUB 9500:GOTO 2050
2080 IF DP%=0 THEN A$=A$+".rul"
2090 RULEFILE$=A$:IF SEMI% THEN A$=DEFAULT$+".dat":GOTO 2190
2100 PRINT "Enter Output File name (";DEFAULT$;".dat) ";
2110 A$="":INPUT A$:IF A$=";" THEN SEMI%=-1:A$=""
2120 IF A$="" THEN A$=DEFAULT$+".dat":GOTO 2190
2130 GOSUB 9000:GOSUB 9100:IF ER% THEN GOSUB 9500:GOTO 2100
2140 IF DP%=0 THEN A$=A$+".dat"
2190 OUTFILE$=A$:IF SEMI% THEN LST%=0:RETURN
2200 PRINT "Enter List File Name or device (nul.lst) ";
2210 A$="":INPUT A$:IF A$="" THEN LST%=0:RETURN
2220 GOSUB 9000:IF ER% THEN GOSUB 9500:GOTO 2200
2230 GOSUB 9960:IF RIGHT$(B$,3)="con" THEN LST%=1:RETURN
2240 IF RIGHT$(B$,3)="prn" THEN LST%=3:RETURN
2250 IF RIGHT$(B$,3)="nul" THEN LST%=0:RETURN
2260 LST%=2:IF DP%=0 THEN A$=A$+".lst"
2270 OPEN "o",#2,A$:RETURN
2470 REM
2480 REM  **** open attribute file and read attributes
2490 REM
2500 PRINT:PRINT "Reading Attributes file - ";ATTRFILE$:PRINT
2502 A$="Attributes file - "+ATTRFILE$:IF LST%=3 THEN LPRINT A$:LPRINT
2503 IF LST%=2 THEN PRINT #2,A$:PRINT #2,""
2505 OPEN "i",#1,ATTRFILE$
2510 NUMATTR%=0:TYPE%=1:NUMER%=0
2550 IF EOF(1) THEN GOTO 2900
2560 LINE INPUT #1,CURL$:A$=CURL$:GOSUB 8800
2570 GOSUB 9900:IF A$="" THEN GDTO 2550
2580 IF LEFT$(A$,LEN(COMMENT$))=COMMENT$ THEN GOTO 2550
2590 ON TYPE% GOTO 2600,2650,2700
2597 REM
2598 REM  **** check for definition line ****
2599 REM
2600 GOSUB 9960:IF LEFT$(B$,5)="title" THEN GOTO 2640
2605 IF LEFT$(B$,6)<>"define" THEN MS="Command expected":GDTD 2950
2610 A$=MID$(A$,7):GOSUB 9900:GOSUB 9800
2620 NUMATTR%=NUMATTR%+1
2622 IF NUMATTR%>MAXATTR% THEN MS="Too many Attributes":GOTO 2950
2625 ATTR$(NUMATTR%)=A$:TYPE%(NUMATTR%)=0
2630 TYPE%=2:GOTO 2560
2640 GOSUB B900:TITLE$=TXT$:TITL%=-1:GOTO 2560
2647 REM
2648 REM  **** check for starting bracket ****
2649 REM
2650 IF LEFT$(A$,1)<>BRACKSTART$ THEN H$="Start Bracket Expected":GOTO 2950
2660 TYPE%=3:GOTO 2550
2696 REM
2697 REM  **** check for end block bracket ****
2698 REM  **** check for describe,verb,options and ask lines ****
2699 REM
2700 GOSUB 9960
2702 IF LEFT$(B$,1)<>BRACKEND$ THEN GOTD 2710
2704 TYPE%=1:IF ASK$(NUMATTR%)="" THEN TYPE%(NUMATTR%)=-TYPE%(NUMATTR%)
2705 GOTO 2550
2710 IF LEFT$(B$,8)="describe" THEN GOSUB 8000:GOTO 2550
2720 IF LEFT$(B$,4)="verb" THEN GOSUB B100:GDTD 2550
2730 IF LEFT$(B$,7)<>"options" THEN GOTO 2740
2735 GOSUB B200:IF ER%=-1 THEN GOTD 2950
2737 GOTO 2550
2740 IF LEFT$(B$,3)="ask" THEN GOSUB B400:GOTO 2550
2750 M$="Illegal Sub-command":GOTO 2950
2900 IF TYPE%<>1 THEN PRINT "File Not Finished":NUMER%=NUMER%+1
2905 DUP%=0:IF NUMATTR%<2 THEN GOTO 2940
2910 FOR X%=1 TO NUMATTR%
2915   FOR Y%=1 TO NUMATTR%
2920     IF X%<>Y% AND ATTR$(X%)=ATTR$(Y%) THEN DUP%=-1
2925   NEXT Y%
2930 NEXT X%
2935 IF DUP% THEN PRINT "Duplication of Attribute Names":NUMER%=NUMER%+1
2940 CLOSE #1:PRINT:RETURN
2947 REM
2948 REM  **** error in attributes file ****
2949 REM
2950 ER%=0:NUMER%=NUMER%+1:IF LST%<>1 THEN PRINT CURL$
2955 A$="Error ":IF H$<>"" THEN A$=A$+" - "+H$:H$=""
2957 PRINT BELL$;A$:IF LST%<>1 THEN GOSUB BB00
2960 PRINT:A$="":IF LST%<>1 THEN GOSUB B800
2965 GOTO 2550
2970 REM
2980 REM  **** Read in rules file ****
2990 REM
3000 PRINT:PRINT "Reading Rules file - ";RULEFILE$:PRINT
3002 A$=CHR$(12)+"Rules file - "+RULEFILE$:IF LST%=3 THEN LPRINT A$:LPRINT
3003 IF LST%=2 THEN PRINT #2,A$:PRINT #2,""
3005 OPEN "i",#1,RULEFILE$
3010 RULE%=0:PTR%=0:NUMER%=0
3050 IF EOF(1) THEN GOTO 3900
3060 LINE INPUT #1,CURL$:A$=CURL$:GOSUB B800
3070 GOSUB 9900:GOSUB 9960
3075 IF A$="" OR LEFT$(A$,LEN(COMMENT$))=COMMENT$ THEN GOTO 3050
3080 IF LEFT$(A$,4)<>"rule" THEN M$="'Rule' expected":GOTO 3950
3090 RULE%=RULE%+1:IF RULE%>MAXRULE$% THEN M$="Too many rules":GOTO 3950
3100 IF EOF(1) THEN GOTO 3900
3110 LINE INPUT #1,CURL$:A$=CURL$:GOSUB 8800
3120 GOSUB 4100:IF EXCLUDE% THEN H$="'NOT' not allowed here":ER=-1
3122 IF ER% THEN GDTD 3950
3125 CONC%(RULE%,0)=ATTR%:CONC%(RULE%,1)=ATVAL%:UNK%(ATTR%)=-1
3127 REM
3128 REM  **** get if line of rule ****
3129 REM
3130 IF EOF(1) THEN GOTO 3900
3140 LINE INPUT #1,CURL$:A$=CURL$:GOSUB 8B00
3145 IF A$="" OR LEFT$(A$,LEN(COMMENT$))=COMMENT$ THEN GOTO 3130
3150 GOSUB 9900:GOSUB 9960
3160 IF LEFT$(A$,3)<>"if " THEN H$="'IF' expected":GOTO 3950
3170 A$=MID$(A$,4):GOSUB 4100:IF ER%=-1 THEN GOTO 3950
3180 PTR%=PTR%+1:IF PTR%>MAXCL% THEN H$="Too many conditions":GOTD 3950
3185 CONC%(RULE%,2)=PTR%
3190 TEST%(PTR%,0)=ATTR%:TEST%(PTR%,1)=ATVAL%
3192 IF EXCLUDE%<>0 THEN TEST%(PTR%,3)=EXCLUDE%
3194 IF COMP%<>0 THEN TEST%(PTR%,3)=COMP%
3197 REM
3198 REM  **** get remaining lines of rule if there is a 'and' in front ****
3199 REM
3200 IF EOF(1) THEN GOTO 3900
3210 LINE INPUT #1,CURL$:A$=CURL$:GOSUB BB00
3220 IF A$="" OR LEFT$(A$.LEN(COMMENT$))=COMMENT$ THEN GOTO 3200
3230 GOBUB 9900:GOBUB 9960
3235 IF LEFT$(A$,4)="rule" THEN GOTO 3090
3240 IF LEFT$(A$,4)<>"and " THEN GOTO 3950
3250 A$=MID$(A$,5):GOSUB 4100:IF ER%=-1 THEN GOTO 3950
3260 TEST%(PTR%,2)=1:PTR%=PTR%+1
3270 TEST%(PTR%,0)=ATTR%:TEST%(PTR%,1)=ATVAL%
3272 IF EXCLUDE%<>0 THEN TEST%(PTR%,3)=EXCLUDE%
3274 IF COMP%<>0 THEN TEST%(PTR%,3)=COMP%
32B0 GOTO 3200
3900 CLOSE #1:RETURN
3947 REM
3948 REM  **** error in rule file ****
3949 REM
3950 ER%=0:IF LST%<>1 THEN PRINT CURL$
3960 A$="Error":IF H$<>"" THEN A$=A$+" - "+M$:M$=""
3965 PRINT BELL$;A$:IF LST%<>1 THEN GOSUB 8800
3970 PRINT:A$="":IF LST%<>1 THEN GOSUB 8800
3980 NUMER%=NUMER%+1:GOTO 3050
3997 REM
3998 REM  **** display error numbers etc ****
3999 REM
4000 IF TITLE%=0 THEN A$="Warning No Title Line !":GOSUB 4080:A$=" ":GOSUB 4080
4010 A$="Errors          -"+STR$(NUMER%):GOSUB 4080
4020 A$="Number Attributes -"+BTR$(NUMATTR%):GOSUB 40B0:RETURN
4030 A$=" ":GOSUB 4080:A$="Errors          -"+STR$(NUMER%):GOSUB 40B0
4040 A$="Number of Rules   -"+STR$(RULE%):GOSUB 4080
4050 A$="Number of Conditions -"+STR$(PTR%):GOSUB 4080:RETURN
40B0 IF LBT%<1 THEN PRINT A$
4090 GDBUB B800:RETURN
4897 REM
4898 REM  **** evaluate line to grab attribute and value ****
4899 REM
```

```
4100 ER%=0:M$="":EXCLUDE%=0:CDMP%=0
412B GOSUB 9900:GOSUB 996B:ATTR$=""
4127 REM
4128 REM  **** get next word from input string until it is an attribute ****
4129 REM
4130 GOSUB 4800:IF ATTR$="" THEN ATTR$=B$:GOTD 4140
4135 ATTR$=ATTR$+" "+B$
4140 GOSUB 4700:IF FOUND%=-1 THEN GOTO 4170
4150 IF A$="" THEN M$="Attribute unknown":ER%=-1:RETURN
4160 GOTD 4130
4170 ATTR%=X%
4177 REH
417B REH  **** check verb or comparison for numbers ****
4179 REH
41B0 GOSUB 4800:IF A8S(TYPE%(ATTR%))=2 THEN GOSUB 4600:GOTO 4186
41B5 IF VERB$(ATTR%)<>"" AND B$<>VERB$(ATTR%) THEN M$="Illegal verb":ER%=-1
4186 IF ER%=-1 THEN RETURN
4187 REM
418B REH  **** get value of attribute ****
41B9 REM
4190 ATVAL$=""
4192 GDSUB 4B00:IF B$="not" THEN EXCLUDE%=-1:GOSUB 48B0
4200 IF ATVAL$="" THEN ATVAL$=B$:GOTO 4210
4205 ATVAL$=ATVAL$+" "+B$
4210 IF A$<>"" THEN GOSUB 4800:GOTO 4200
4215 IF A8S(TYPE%(ATTR%))=1 THEN GOTO 4300
4217 IF A8S(TYPE%(ATTR%))=2 THEN GOTO 4400
4220 X%=1:FOUND%=0
4230 IF ATVAL$=GP$(ATTR%,X%) THEN FOUND%=-1:GOTO 4260
4240 X%=X%+1:IF X%<=NOP%(ATTR%) THEN GOTO 4230
4260 IF FOUND%=0 TMEN M$="Undefined Value for this Attribute":ER%=-1:RETURN
4270 ATVAL%=K%:RETURN
4297 REM
4298 REM  **** check for yes/no ****
4299 REM
4300 IF ATVAL$="yes" OR ATVAL$="true" TMEN ATVAL%=1:RETURN
4310 IF ATVAL$="no" OR ATVAL$="false" THEN ATVAL%=2:RETURN
432B M$="True or false expected":ER%=-1:RETURN
4397 REM
4398 REM  **** check number in range ****
4399 REM
4400 ATVAL%=VAL(ATVAL$)
4410 IF ATVAL%>=VAL(OP$(ATTR%,1)) AND ATVAL%<=VAL(OP$(ATTR%,2)) THEN RETURN
4420 ATVAL%=0:ER%=-1:M$="Value Outside Defined Range":RETURN
4597 REM
459B REH  **** check comparison eg <,<=,=,>=,> or <> ****
4599 REM
4600 ATVAL%=0:IF B$="<" THEN ATVAL%=1
4610 IF B$="<=" OR B$="=<" THEN ATVAL%=2
4620 IF B$="=" THEN ATVAL%=3
4630 IF B$=">=" OR B$="=>" THEN ATVAL%=4
4640 IF B$=">" THEN ATVAL%=5
4650 IF B$="<>" OR B$="><" THEN ATVAL%=6
4660 IF ATVAL%=0 TMEN ER%=-1:M$="Illegal Comparison"
4670 COMP%=ATVAL%:RETURN
4697 REH
4698 REH  **** check to see if attr$ is a legal attribute ****
4699 REM
4700 X%=1:FOUND%=0
4710 IF ATTR$=ATTR$(X%) THEN FOUND%=-1:RETURN
4720 X%=X%+1:IF X%<=NUMATTR% THEN GOTO 4710
4740 RETURN
4797 REM
4798 REM  **** strip next word from a$ ****
4799 REM
4800 A%=INSTR(A$," "):IF A%=0 THEN B$=A$:A$="":RETURN
4810 B$=LEFT$(A$,A%-1):A$=MID$(A$,A%+1)
4820 RETURN
4997 REM
4998 REM  **** output file ****
4999 REM
5000 PRINT:PRINT "Saving Data to file - ";DUTFILE$
5010 OPEN "o",#1,DUTFILE$
5020 PRINT #1,TITLE$
5030 PRINT #1,NUHATTR%
5040 FOR X%=1 TO NUHATTR%
5050   PRINT #1,ATTR$(X%)
5060   PRINT #1,DESC$(X%)
507B   PRINT #1,VERB$(X%)
5080   PRINT #1,ASK$(X%)
5090   PRINT #1,TYPE%(X%)
5100   PRINT #1,UNK%(X%)
5110   PRINT #1,NOP%(X%)
5120   IF NOP%(X%)<>0 THEN FOR Y%=1 TO NOP%(X%):PRINT #1,OP$(X%,Y%):NEXT Y%
5130 NEXT X%
5140 PRINT #1,RULE%
5150 FOR X%=1 TO RULE%
5160   PRINT #1,CONC%(X%,0):PRINT #1,CONC%(X%,1):PRINT #1,CONC%(X%,2)
5170 NEXT X%
5180 PRINT #1,PTR%
5190 FOR X%=1 TO PTR%
5200   FOR Y%=B TO 3:PRINT #1,TEST%(X%,Y%):NEXT Y%
5210 NEXT X%
5220 CLOSE #1
5230 RETURN
7997 REH
7998 REM  **** get describe text ****
7999 REM
8000 GOSUB 8900
8010 DESC$(NUMATTR%)=TXT$:RETURN
8097 REM
809B REM  ****  verb ****
8099 REM
81B0 GOSUB 8900
B110 VERB$(NUMATTR%)=TXT$:RETURN
8197 REM
8198 REH  **** options ****
8199 REM
8200 GOSUB 8900
8210 A$=TXT$:GOSUB 9960:OP%=1
8220 IF LEFT$(B$,7)="boolean" THEN TYPE%(NUHATTR%)=1:RETURN
8230 IF LEFT$(B$,6)="number" THEN TYPE%(NUHATTR%)=2:TXT$=HID$(TXT$,8):GOTO 8250
8240 TYPE%(NUMATTR%)=3:A$=TXT$:GOSUB 9960:TXT$=B$
8250 IF LEFT$(TXT$,1)=" " AND TXT$<>" " TMEN TXT$=MID$(TXT$,2):GOTD 825B
8260 A%=INSTR(TXT$," ")
8265 IF A%=0 THEN A$=TXT$:GOSUB 9800:DP$(NUHATTR%,OP%)=A$:GOTO 829B
8270 A$=LEFT$(TXT$,A%-1):GOSUB 9800:OP$(NUMATTR%,OP%)=A$
8280 TXT$=MID$(TXT$,A%+1):OP%=OP%+1
82B2 IF OP%>20 TMEN M$="Too many options":ER%=-1:RETURN
8285 GDTO B250
8290 NOP%(NUMATTR%)=OP%:IF TYPE%(NUMATTR%)<>2 THEN RETURN
8297 REM
8298 REM  **** check number range ****
8299 REM
8300 IF OP%<2 OR OP%>3 THEN H$="Illegal Number of Parameters":ER%=-1:RETURN
8310 A1=VAL(OP$(NUMATTR%,1)):A2=VAL(DP$(NUHATTR%,2))
8320 IF A1>0 AND A2>0 ANO A2>A1 AND A1<32768! AND A2<32768! TMEN GDTO 8330
8325 H$="Numeric Range error":ER%=-1
8330 IF OP%=2 THEN OP$(NUMATTR%,3)=""
B340 OP%=3:RETURN
8397 REM
8398 REH  **** get question ****
8399 REM
8400 GOSUB 8900
8410 ASK$(NUHATTR%)=TXT$:RETURN
B770 REH
8780 REM  **** output list file depending on parameter ****
8790 REH
8800 IF LST%=0 THEN RETURN
8810 LC%=LC%+1:L$=RIGHT$("    "+STR$(LC%),4)+":  "
882B ON LST% GOTO 883B,8840,8850
8830 PRINT L$;A$:RETURN
8840 PRINT #2,L$;A$:RETURN
8850 LPRINT L$:A$:RETURN
887B REM
8880 REH  **** get text between single quotes ****
8890 REM
8900 TXT$=""
8910 A%=INSTR(A$,"'"):IF A%=0 THEN GOTO 8960
8920 A$=MID$(A$,A%+1):A%=INSTR(A$,"'"):IF A%=0 THEN GDTO 8960
8930 TXT$=TXT$+LEFT$(A$,A%-1)
8940 GOSUB 9800
8950 IF RIGHT$(A$,1)<>"'" THEN RETURN
8955 IF NOT(EOF(1)) THEN LINE INPUT #1,CURL$:A$=CURL$:GOSUB 8800:GOTD 8910
8960 RETURN
8970 REM
89B0 REM  **** check input file name for illegal characters ****
8990 REM
9000 DR$="":ER%=0:SEHI%=0:IF A$="" THEN ER%=-1:RETURN
9005 IF RIGHT$(A$,1)=":" THEN SEMI%=-1:A$=LEFT$(A$,LEN(A$)-1)
9007 IF MID$(A$,2,1)=":" THEN DR$=LEFT$(A$,2):A$=MID$(A$,3)
9010 FDR X%=1 TO LEN(A$)
9020  B$=MID$(A$,X%,1)
9030  IF INSTR(CHECK$,B$)=0 THEN ER%=-1
9040 NEXT X%
9050 IF ER%=-1 THEN RETURN
9060 A%=INSTR(A$,"."):IF INSTR(A%+1,A$,".")<>0 THEN ER%=-1:RETURN
9070 IF A%=1 OR (LEN(A$)>B AND A%=0) THEN ER%=-1
9080 IF A%<>0 AND LEN(A$)-A%>3 THEN ER%=-1
9090 DP%=INSTR(A$,"."):A$=OR$+A$:RETURN
9097 REM
909B REM  **** check for special names and return error ****
9099 REM
9100 GOSUB 9960
911B IF B$="con" OR B$="prn" OR B$="nul" THEN ER%=-1
9120 RETURN
947B REM
94B0 REM  **** illegal file name entered ****
9490 REM
9500 PRINT "Illegal Filename"+BELL$
9510 RETURN
9770 REM
9780 REM  **** strip off trailing spaces ****
9790 REH
9880 IF A$=" " THEN A$="":RETURN
9B10 IF RIGHT$(A$,1)=" " THEN A$=LEFT$(A$,LEN(A$)-1):GOTO 9800
9820 RETURN
9870 REM
9BB0 REM  **** strip off leading spaces ****
9890 REM
9900 IF LEFT$(A$,1)=" " AND A$<>" " THEN A$=HID$(A$,2):GOTO 9900
9910 IF A$=" " TMEN A$=""
9920 RETURN
9930 REH
9940 REH  **** convert to lower case ****
9950 REM
9960 B$="":IF A$="" TMEN RETURN
9970 FDR X%=1 TO LEN(A$):A%=ASC(MID$(A$,X%,1))
9980 IF A%>64 AND A%<91 THEN A%=A%+32
9985 B$=B$+CHR$(A%)
9990 NEXT X%:RETURN

920 REM  ************************************************************
910 REM  * Simple Expert System / Experiment in Artificial Intelligence *
92B REM  *                                                            *
930 REH  * Written by Mark Needham       EXPRUN            November 1985 *
940 REM  ************************************************************
970 REM
980 REM  **** these arrays are dimensioned to max number of rules ****
990 REM
1B00 DIH CONC%(100,2),S%(100),RULE%(100),QUEST%(100)
1007 REM
1008 REH  **** this array is dimensioned to max number of clauses ****
1009 REM
1010 DIH TEST%(2B0,3)
1017 REM
1B1B REM  **** these arrays are dimensioned to max number of attributes ****
1019 REM
1020 DIM ATVAL%(40),TYPE%(40),ATTR$(40),DESC$(40),VERB$(40),OP$(4B,20)
1030 DIH NOP%(40),ASK$(40),CONCFROH%(40),DISP$(40),UNK%(40)
1B40 CHECK$=".ABCDEFGHIJKLHNOPQRSTUVWXYZ!@$%&()[]abcdefghijklmnopqrstuvwxyz'"
1060 HEADING$="-":DIM C$(6):BELL$=CHR$(7)
1070 REM def fna$(x%)=right$(str$(x%),2)
1080 M$=" equal to":C$(0)="is":EXPLAIN%=0:EXPLAIN$="Off"
1085 C$(1)="is less than":C$(2)=C$(1)+" or"+H$:C$(6)="is not"+M$
1090 C$(3)="is"+H$:C$(4)="is greater than":C$(5)=C$(4)+" or"+M$
1100 GOSUB 1900                    :REM  display main heading
1110 GOSUB 2000                    :REM  get file names
1120 GOSUB 3B00                    :REH  read data in
1130 GDSUB 2500                    :REM  initialize flag arrays
1140 GOSUB 3500                    :REM  work it out
1145 IF ABORT%=-1 THEN GOTD 1200
1147 REM
1148 REM  **** display answer or error ****
1149 REM
1150 IF ATVAL%(S%(1))=-1 THEN GOSUB 9100:PRINT:PRINT "No Answer":GDSUS 6500:GOTO
 1200
1160 TYPE%=TYPE%(S%(1)):OESC$=DESC$(S%(1)):ATVAL%=ATVAL%(S%(1)):ATTR%=S%(1)
1170 VERB$=VERB$(S%(1)):GOSUB 9100:PRINT:PRINT "I conclude that ";
1180 REV%=0:GOSUB 4500:PRINT ANS$
1190 GOSUB 9300
1197 REH
1198 REH  **** Options Menu ****
1199 REM
1200 DISP$(1)="Re-run Current Data File":DISP$(2)="Display All Values"
1210 DISP$(3)="Proove Attribute Values"
1220 DISP$(4)="Swap Explain . Currently "+EXPLAIN$
1230 DISP$(5)="Load and Run New Data File"
1240 DISP$(6)="End Program"
12B0 NUMOP%=6:TYPE%=3:ASK$="":HEAD$="Main Options Menu":Q%=0:GOSUB 4000
12B5 IF A%=-2 THEN GOTO 12B0
1288 IF A%>4 AND LST%=2 THEN CLOSE #2
1290 DN A% GDTO 1130,1400,1500,2300,1100,1300
1300 END
1397 REM
139B REM  **** display other attributes if they have values ****
1399 REM
1400 HEAD$="Display Attribute Values":GOSUB 9100:IF LST%<>0 THEN GoSUB 2650
141B FOR X%=1 TD NUMATTR%
1420   IF ATVAL%(X%)<>0 THEN GOTO 1450
1425   POUT$="":IF CONCFROM%(X%)=0 THEN POUT$="User";GOTD 1430
1427   POUT$="Rule"+STR$(CONCFROH%(X%))
1430   TYPE%=TYPE%(X%):DESC$=DESC$(X%):ATVAL%=ATVAL%(X%):ATTR%=X%
1440   VERB$=VERB$(X%):REV%=0:GOBUB 4500:POUT$=LEFT$(POUT$+8PACE$(10),10)+ANB$
1445   GOSUB 2600
1450 NEXT X%:IF LST%=1 THEN LPRINT CHR$(12)
1460 GOSUB 9300
```

```
1470 GOTO 1200
1497 REM
1498 REM  **** Display Proof for Attribute Value ****
1499 REM
1500 HEAD$="Display Attribute Value Proof":GOSUB 2650
1505 NUMOP%=NUMATTR%
1510 FOR X%=1 TO NUMATTR%:DISP$(X%)=ATTR$(X%):NEXT X%
1520 GOBUB 5000:IF A%=0 THEN GOTO 1800
1530 GOSUB 9100
1540 TYPE%=TYPE%(A%):DESC$=DESC$(A%):ATVAL%=ATVAL%(A%):ATTR%=A%
1550 VERB$=VERB$(A%)
1560 IF ATVAL%>0 THEN GOTO 1600
1567 REM
1568 REM  **** fact is unknown ****
1569 REM
1570 POUT$="";IF ABB(TYPE%)=1 THEN POUT$="The fact that "
1580 REV%=0:GoSUB 4500:POUT$=POUT$+ANS$:GOSUB 2600
1590 GOTO 1790
1597 REM
1598 REM  **** fact is known either from the user or deduced from a rule ****
1599 REM
1600 IF CONCFROM%(A%)<>0 THEN GOTO 1700
1610 POUT$="You supplied the fact that ":REV%=B:GOSUB 4500:POUT$=POUT$+ANS$:GOSU
B 2600
1620 GOTO 1790
1697 REM
1698 REM  **** display the rule that evaluated the fact ****
1699 REM
1700 I%=A%:REV%=0:GOSUB 4500:A%=I%:POUT$=ANS$:GOSUB 2600:M$=ANS$
1710 POUT$="was evaluated using rule"+STR$(CONCFROM%(A%))+". This rule states th
at:":GOSUB 2600
1720 POUT$="":OOSUB 2600:POUT$="  If ":X%=CONC%(CONCFROM%(A%),2)
1730 A%=TEST%(X%,0):REV%=TEST%(X%,3)
1740 TYPE%=TYPE%(A%):DESC$=DESC$(A%):ATVAL%=TEST%(X%,1):ATTR%=A%
1750 VERB$=VERB$(A%):OOSUB 4500:POUT$=POUT$+ANS$:OOBUB 2600
1760 IF TEST%(X%,2)<>0 THEN X%=X%+1:POUT$="  And ":OOTO 1730
1770 POUT$="  Then "+M$:OOSUB 2600
1790 POUT$="":OoSUB 2600:GOSUB 9300:GOTO 1505
1800 IF LST%=1 THEN LPRINT CHR$(12)
1810 GOTO 1200
1870 REM
1880 REM  **** display program name as a heading ****
1890 REM
1900 PRINT
1910 PRINT "Simple Expert System RUN TIME Program Version 1.0"
1920 PRINT
1930 RETURN
1970 REM
1980 REM  **** Get file names from user ****
1990 REM
2000 PRINT "Enter Data Definition File Name (.dat) ";
2010 A$="":INPUT A$:GOSUB 9000
2020 IF ER% THEN GOSUB 9500:GOTO 2000
2030 IF DP%=0 THEN A$=A$+".dat":DP%=INSTR(A$,".")
2040 RDATAFILE$=A$:DEFAULT$=LEFT$(A$,DP%-1)
2045 IF SEHI% THEN LST%=0:RETURN
2196 REM
2197 REM  **** options 2 & 3 from the main menu can output to a ****
2198 REM  **** printer or file if this is not NUL                 ****
2199 REM
2200 PRINT "Enter List File Name or device (nul,lst) ";
2210 A$="":INPUT A$:IF A$="" THEN LST%=0:RETURN
2220 GOSUB 9000:IF ER% THEN GOSUB 9500:GOTO 2200
223B GOSUB 9960:IF RIGHT$(A$,3)="con" THEN GOSUB 9500:GOTO 2200
2240 IF RIGHT$(A$,3)="prn" THEN LST%=1:RETURN
2250 IF RIGHT$(A$,3)="nul" THEN LST%=0:RETURN
2260 LST%=2:IF DP%=0 THEN A$=A$+".lst"
2270 OPEN "o",#2,A$
2280 RETURN
2297 REM
2298 REM  **** Swap explain mode ****
2299 REM
2300 EXPLAIN%=1-EXPLAIN%
2310 EXPLAIN$="On":IF EXPLAIN%=0 THEN EXPLAIN$="Off"
2330 GOTO 1200
2497 REM
2498 REM  **** Initialise Data ****
2499 REH
2500 FOR X%=1 TO NUMATTR%
2510   ATVAL%(X%)=0:QUEST%(X%)=0:CONCFROM%(X%)=0
2520 NEXT X%
2530 FOR X%=1 TO NUMRULES%
2540   RULE%(X%)=0
2550 NEXT X%
2560 RETURN
2597 REM
2598 REM  **** output to screen, printer or file
2599 REM
2600 PRINT POUT$
2610 IF LST%=1 THEN LPRINT POUT$
2620 IF LST%=2 THEN PRINT #2,POUT$
2630 RETURN
2650 POUT$=BTRING$(79,HEADING$):GOSUB 2610
2660 POUT$=SPACE$(39-INT(LEN(TITLE$)/2))+TITLE$:GOSUB 2610
2670 POUT$=STRING$(79,HEADING$):GOSUB 2610
2680 POUT$=BPACE$(39-INT(LEN(HEAD$)/2))+MEAD$:GOSUB 2610
2685 POUT$="":GOSUB 261B
2690 RETURN
2997 REM
2998 REM  **** Read in Data File ****
2999 REH
3000 PRINT:PRINT "Reading Data File"
3010 OPEN "i",#1,RDATAFILE$
3015 INPUT #1,TITLE$
3020 INPUT #1,NUHATTR%
3030 FOR X%=1 TO NUMATTR%
3040   INPUT #1,ATTR$(X%),DESC$(X%),VERB$(X%),ASK$(X%),TYPE%(X%),UNK%(X%),NDP%(X
%)
3050   IF NOP%(X%)<>0 THEN FOR Y%=1 TO NOP%(X%):INPUT #1,OP$(X%,Y%):NEXT Y%
3060 NEXT X%
3070 INPUT #1,NUMRULES%
3080 FOR X%=1 TO NUMRULES%
3090   INPUT #1,CDNC%(X%,0),CONC%(X%,1),CONC%(X%,2)
3100 NEXT X%
3110 INPUT #1,NUMCL%
3120 FOR X%=1 TO NUMCL%
3130   INPUT #1,TEBT%(X%,0),TEST%(X%,1),TEBT%(X%,2),TEST%(X%,3)
3140 NEXT X%
3150 CLOSE #1
3160 RETURN
3497 REM
3498 REM  **** get thing that the user wants to find out about ****
3499 REM
3500 NUMOP%=NUMATTR%:HEAD$="Select Attribute You Want Evaluated"
3510 FOR X%=1 TO NUHATTR%:DISP$(X%)=ATTR$(X%):NEXT X%
3520 ABORTI=0:GOSUB 5000:IF A%=0 THEN ABORTI=-1:RETURN
3530 SPTR%=1:S%(1)=A%:SEARCH%=A%:MEAD$="Running Expert System"
3597 REH
3598 REH  **** if a question can be used ask it ****
3599 REM
3600 IF SON(TYPE%(S%(SPTR%)))=-1 OR QUEST%(S%(SPTR%))=-1 THEN GOTO 3800
3610 ASK$=ASK$(S%(SPTR%)):NUMOP%=NOP%(S%(SPTR%))
3615 IF EXPLAIN% THEN GOSUB 9300
3620 IF NUHOP%<>0 THEN FOR X%=1 TO NUMOP%:DISP$(X%)=OP$(S%(SPTR%),X%):NEXT X%
3630 TYPE%=TYPE%(S%(SPTR%)):OX=UNK%(S%(SPTR%)):GOSUB 4000
3635 IF A%=-2 THEN ABORT%=-1:RETURN
3640 IF A%=-1 THEN QUEST%(S%(SPTR%))=-1:GOTO 3800
3650 ATVAL%(S%(SPTR%))=A%
3660 GOTO 3900
3797 REM
3798 REM  **** find rule that gives required answer ****
3799 REH
3800 X%=1
3810 IF CONC%(X%,0)=S%(SPTR%) AND RULE%(X%)=0 THEN GOTO 3850
3820 X%=X%+1:IF X%<=NUMRULES% THEN GOTD 3810
3830 GOTO 39B0
3847 REM
3848 REM  **** check all clauses are true ****
3849 REM
3850 CURULE%=X%:CL%=CONC%(CURULE%,2)
3B60 IF ATVAL%(TEST%(CL%,0))=0 THEN GOSUB 7000:GOTD 3600
3870 GOSUB 7300:IF PASS%=0 THEN GOTO 3800
3880 IF TEST%(CL%,2)=1 THEN CL%=CL%+1:GOTO 3B60
3887 REM
3888 REH  **** current rule has passed ****
3889 REM
3890 ATVAL%(S%(SPTR%))=CONC%(CURULE%,1):RULE%(CURULE%)=-1
3895 CONCFRDM%(S%(SPTR%))=CURULE%
3897 REH
3898 REH  **** pop off stack ****
3899 REM
3900 SPTR%=SPTR%-1
3910 IF SPTR%<>0 THEN GOTO 3600
3920 RETURN
3977 REM
3978 REH  **** no answer found for current goal ****
3979 REM
3980 IF SPTR%=1 THEN ATVAL%(S%(1))=-1
3985 RULE%(CURULE%)=-2
3990 GOTO 3900
3997 REM
3998 REH  **** get a selected number numop% is the range ****
3999 REM
4000 GOSUB 9100:IF ASK$<>"" THEN GOSUB 4400:PRINT
4005 IF ABS(TYPE%)=1 THEN GOTD 4200
4006 IF ABS(TYPE%)=2 THEN GOTO 4300
4010 FOR X%=1 TO 10
4020   A$=""
4030   IF X%<=NUMOP% THEN A$=" "+LEFT$(RIGHT$(STR$(X%),2)+" ":"+DISP$(X%)+SPACE$
(37),37)+" "
4040   IF X%+1B<=NUHOP% THEN A$=A$+LEFT$(RIGHT$(STR$(X%+1B),2)+" ":"+OISP$(X%+10
)+SPACE$(37),37)+" "
4060   IF A$<>"" THEN PRINT A$
407B NEXT X%:PRINT
4090 PRINT "Enter Option (1-"+STR$(NUMOP%)+") '*' to Abort ";
4095 IF Q%=-1 THEN PRINT "'?' if unknown ";
4097 A$="":INPUT A$:IF A$="*" THEN A%=-2:RETURN
4100 IF A$="?" AND Q%=-1 THEN A%=-1:RETURN
4105 IF A$="why" THEN GOSUB 6000:GOTO 4000
4110 A%=INT(VAL(A$))
4120 IF A%<1 OR A%>NUHOP% THEN GOSUB 9200:GOTO 4000
4130 RETURN
4197 REH
4198 REH  **** get Yes/No answer ****
4199 REH
4200 PRINT " 1 : Yes / True";PRINT " 2 : No / False"
4210 PRINT:PRINT "Enter Option (1 - 2) '*' to Abort ";:A$=""
4220 IF Q%=-1 THEN PRINT "'?' if unknown ";
4240 INPUT A$:IF A$="*" THEN A%=-2:RETURN
4241 IF A$="?" AND Q%=-1 THEN A%=-1:RETURN
4245 IF A$="why" THEN GOSUB 6000:TYPE%=1:GOTO 4B00
4250 A%=INT(VAL(A$))
4260 IF A%<1 OR A%>2 THEN GOSUB 9200:GDTO 4000
4270 RETURN
4297 REH
4298 REM  **** get value in range ****
4299 REH
4300 A1%=VAL(DP$(S%(SPTR%),1)):A2%=VAL(OP$(S%(SPTR%),2))
4310 PRINT:PRINT "Enter Value >=";A1%;" and <=";A2%;
4320 IF OP$(S%(SPTR%),3)<>"" THEN PRINT " in ";OP$(S%(SPTR%),3);" ";
4325 IF Q%=-1 THEN PRINT "'?' if unknown ";
4330 INPUT A$:IF A$="*" THEN A%=-2:RETURN
4340 IF A$="?" AND Q%=-1 THEN A%=-1:RETURN
4350 IF A$="why" THEN GOSUB 6000:TYPE%=2:GOTO 4000
4360 IF VAL(A$)<A1% OR VAL(A$)>A2% THEN GOSUB 9200:GOTO 4000
4370 A%=VAL(A$):RETURN
4397 REH
4398 REH  **** display question splitting it up if over 80 characters ****
4399 REM
4400 IF LEN(ASK$)<B0 THEN GOTO 4450
4410 A$=LEFT$(ASk$,79)
4420 IF RIGHT$(A$,1)<>" " THEN A$=LEFT$(A$,LEN(A$)-1):GOTO 4420
4430 PRINT A$;ASK$=MID$(ASK$,LEN(A$));GOTO 4400
4450 PRINT ASK$
446B RETURN
4497 REM
4498 REM  **** convert data to english answer ****
4499 REH
4500 TYPE%=ABS(TYPE%):IF ABS(TYPE%)=1 THEN GOTD 4600
4510 IF ABS(TYPE%)=2 THEN GOTO 4700
4520 ANS$=DESC$+" "+VERB$+" ":IF ATVAL%>0 AND REV%<>B THEN ANS$=ANS$+"not "
4530 IF ATVAL%>0 THEN ANS$=ANS$+OP$(ATTR%,ATVAL%):GOTO 4540
4535 ANS$=ANS$+"unknown"
4540 RETURN
4597 REM
4598 REM  **** display description with yes/no answer (type%=1) ****
4599 REM
4600 A$=DESC$:A%=INSTR(A$,"("):IF A%=0 THEN GOTO 4680
4610 B$=LEFT$(A$,A%-1):A$=MIO$(A$,A%+1)
4620 A%=INSTR(A$,"/"):IF A%=0 THEN GOTO 4680
4630 T$=LEFT$(A$,A%-1):A$=MIO$(A$,A%+1)
4640 A%=INSTR(A$,")"):IF A%=0 THEN GOTO 4680
4650 F$=LEFT$(A$,A%-1):A$=HID$(A$,A%+1)
4655 IF ATVAL%<=0 THEN ANS$=B$+T$+" or "+F$+A$+" is unknown":GOTO 4670
4660 IF ATVAL%=1 THEN ANS$=B$+T$+A$:GOTO 4670
4665 ANS$=B$+F$+A$
4670 RETURN
46B0 ANS$=DESC$+" ":IF ATVAL%<=B THEN ANS$=ANS$+"unknown":RETURN
4685 IF REV%<>0 TMEN ANS$=ANS$+"not "
4690 IF ATVAL%=1 THEN ANS$=ANS$+"tru=":GOTO 4695
4692 ANS$=ANS$+"false"
4695 RETURN
4697 REM
4698 REM  **** display description with numeric answer (type%=2) ****
4699 REM
4700 ANS$=DESC$+" ":IF ATVAL%<=0 THEN ANS$=ANS$+"is unknown":RETURN
4710 ANS$=ANS$+C$(REV%)+" "+MID$(STR$(ATVAL%),2)+" "+OP$(ATTR%,3)
4720 RETURN
4995 REM
4996 REH  **** display list of attributes                    ****
4997 REH  **** if the number of attributes is > 45 this routine  ****
4998 REH  **** needs changing.                                 ****
4999 REM
5000 GOSUB 9100
5010 FOR X%=1 TO 15
5020   A$=""
5030   IF X%<=NUMOP% TMEN A$=" "+LEFT$(RIGHT$(STR$(X%),2)+" ":"+DI8P$(X%)+SPACE$
(26),25)+" "
5040   IF X%+15<=NUHOP% THEN A$=A$+LEFT$(RIGMT$(STR$(X%+15),2)+" ":"+DISP$(X%+15
)+SPACE$(26),25)+" "
5050   IF X%+30<=NUHOP% TMEN A$=A$+LEFT$(RIGHT$(STR$(X%+30),2)+" ":"+OISP$(X%+30
)+SPACE$(26),25)
5060   IF A$<>"" TMEN PRINT A$
```

```
5070 NEXT X%:PRINT
5090 PRINT "Enter Attributa Number (1 -"+STR$(NUMOP%)+") 0 to Return to Main Men
u ";:A$=""
5100 INPUT A$
5110 A%=INT(VAL(A$)):IF A%=0 THEN RETURN
5120 IF A%<1 DR A%>NUMOP% THEN GOSUB 9200:GOTD 5000
5130 RETURN
5997 REM
5998 REH  **** answer why question by displaying a rule ****
5999 REH
6000 PRINT
6010 IF SPTR%=1 THEN PRINT "Because you asked for the information":GOTO 6300
6020 A%=S%(SPTR%-1)
6030 TYPE%=TYPE%(A%):DESC$=DESC$(A%):ATVAL%=ATVAL%(A%):ATTR%=A%
6040 VERB$=VERB$(A%)
6050 IF ABS(TYPE%)=1 THEN PRINT "The fact that ";
6060 REV%=0:GDSUB 4500:PRINT ANS$
6070 X%=CONC%(CURULE%,2):D%=0:PRINT "From rule ";CURULE%
60B0 IF X%=0 THEN GOTO 6150
6090 A%=TEST%(X%,0)
6100 IF ATVAL%(A%)<=0 THEN GDTO 6140
6110 TYPE%=TYPE%(A%):DESC$=DESC$(A%):IF ABS(TYPE%)=2 THEN ATVAL%=ATVAL%(A%)
6115 IF ABS(TYPE%)<>2 THEN ATVAL%=TEST%(X%,1)
6120 ATTR%=A%:VERB$=VERB$(A%):REV%=TEST%(X%,3):IF ABS(TYPE%)=2 THEN REV%=0
6122 IF D%=0 THEN PRINT "We know that ";:D%=-1:GOTO 6125
6123 PRINT "And that ";
6125 GOSUB 4500:PRINT ANS$
6140 IF TEST%(X%,2)<>0 THEN X%=X%+1:GOTO 6090
6150 X%=CONC%(CURULE%,2):D%=0
6160 IF X%=0 THEN GOTO 6240
6170 A%=TEST%(X%,0)
6180 IF ATVAL%(A%)>0 THEN GOTO 6230
6190 TYPE%=TYPE%(A%):DESC$=DESC$(A%):ATVAL%=TEST%(X%,1)
6195 REV%=TEST%(X%,3)
6200 ATTR%=A%:VERB$=VERB$(A%)
6210 IF D%=0 THEN PRINT "If we can prove that ";:D%=-1:GOTO 6220
6215 PRINT "And ";
6220 GOSUB 4500:PRINT ANS$
6230 IF TEST%(X%,2)<>0 THEN X%=X%+1:GOTO 6170
624m PRINT "Then we can show that ";
6250 A%=CONC%(CURULE%,0)
6260 TYPE%=TYPE%(A%):DESC$=DESC$(A%):ATVAL%=CONC%(CURULE%,1):ATTR%=A%
6270 VERB$=VERB$(A%):REV%=0:GOSUB 4500:PRINT ANS$
6300 GOSUB 9300:RETURN
6497 REH
649B REM  **** if no answers then display all rules not ruled out ****
6499 REM
6500 D%=0
6510 FOR CURULE%=1 TO NUMRULES%
6520   IF CONC%(CURULE%,0)<>SEARCH% OR RULE%(CURULE%)=-1 THEN GOTO 6550
6522   IF ATVAL%(CONC%(CURULE%,0))<>CONC%(CURULE%,1) THEN GDTO 6550
6530   IF D%=0 THEN PRINT "These rules have not been ruled out":PRINT:D%=-1
6540   GOSUB 6070:PRINT
6550 NEXT CURULE%
6560 IF D%=0 THEN GOSUB 9300
6570 RETURN
6997 REH
699B REM  **** attribute is unknown so put it on search stack ****
6999 REH
7000 SPTR%=SPTR%+1
7010 S%(SPTR%)=TEST%(CL%,0)
7020 IF EXPLAIN% THEN PRINT "Need Value of ";ATTR$(TEST%(CL%,0))
7030 RETURN
7097 REH
7098 REM  **** attribute has a value but not the required one ****
7099 REM
7100 RULE%(CURULE%)=-1:IF EXPLAIN% THEN PRINT "Rule";CURULE%;" cannot be true"
7110 RETURN
7197 REM
719B REM  **** check number passes rule ****
7199 REM
7200 PASS%=0:ATVAL%=ATVAL%(TEST%(CL%,0))
7205 DN TEST%(CL%,3) GOTO 7210,7220,7230,7240,7250,7260
7210 IF ATVAL% < TEST%(CL%,1) THEN PASS%=-1
7215 RETURN
7220 IF ATVAL% <= TEST%(CL%,1) THEN PASS%=-1
7225 RETURN
7230 IF ATVAL% = TEST%(CL%,1) THEN PASS%=-I
7235 RETURN
7240 IF ATVAL% >= TEST%(CL%,1) THEN PASS%=-1
7245 RETURN
7250 IF ATVAL% > TEST%(CL%,1) THEN PASS%=-1
7255 RETURN
7260 IN ATVAL% <> TEST%(CL%,1) THEN PASS%=-1
7265 RETURN
7297 REH
729B REM  **** check attribute and value check with clause ****
7299 REM
7300 IF ABS(TYPE%(TEST%(CL%,0)))<>2 THEN GOTO 7330
7310 GOSUB 7200:IF PASS%=0 THEN GOSUB 7100
7320 RETURN
7330 IF TEST%(CL%,3)=0 AND ATVAL%(TEST%(CL%,0))<>TEST%(CL%,1) THEN GOSUB 7100:PA
SS%=0:RETURN
7340 IF TEST%(CL%,3)=-1 AND ATVAL%(TEST%(CL%,0))=TEST%(CL%,1) THEN GOSUB 7100:PA
SS%=0:RETURN
7350 PASS%=-1:RETURN
8970 REM
8980 REM  **** check input file name for illegal characters ****
8990 REM
9000 ER%=0:SEMI%=0:IF A$="" THEN ER%=-1:RETURN
9005 IF RIGHT$(A$,1)=";" THEN SEMI%=-1:A$=LEFT$(A$,LEN(A$)-1)
9007 IF HID$(A$,2,1)=":" THEN DR$=LEFT$(A$,2):A$=MID$(A$,3)
9010 FOR X%=1 TD LEN(A$)
9020   B$=HID$(A$,X%,1)
9030   IF INSTR(CHECK$,B$)=0 THEN ER%=-1
9040 NEXT X%
9050 IF ER%=-1 THEN RETURN
9060 A%=INSTR(A$,"."):IF INSTR(A%+1,A$,".")<>0 THEN ER%=-1:RETURN
9070 IF A%=1 OR (LEN(A$)>B AND A%=0) THEN ER%=-1
9080 IF A%<>0 AND LEN(A$)-A%>3 THEN ER%=-I
9090 DP%=INSTR(A$,"."):A$=DR$+A$:RETURN
9097 REM
909B REH  **** display main screen heading with a clear screen first ****
9099 REH
9100 REM  **** put code here that clears the screen ****
9110 PRINT STRING$(79,HEADING$)
9120 PRINT SPACE$(39-INT(LEN(TITLE$)/2));TITLE$
9130 PRINT STRING$(79,HEADING$)
9140 PRINT SPACE$(39-INT(LEN(MEAD$)/2));HEAD$:PRINT
9150 RETURN
9197 REM
919B REH  **** sound the bell ****
9199 REM
9200 PRINT BELL$;
9210 RETURN
9297 REM
929B REH  **** wait for RETURN to be pressed ****
9299 REM
9300 A$="":PRIHT:PRINT "Press RETURN to Continue ";
9310 A$=INKEY$:IF A$<>CHR$(I3) THEN GOTO 9310
9320 PRINT:RETURN
947a REM
94am REM  **** illegal file name entered ****
9490 REM
9500 PRINT "Illagal Filename";BELL$
9510 RETURN
9770 REH
9780 REH  **** strip off trailing spaces ****
9790 REM
9800 IF A$=" " THEN A$="":RETURN
9810 IF RIGHT$(A$,1)=" " THEN A$=LEFT$(A$,LEN(A$)-1):GOTO 9800
9820 RETURN
9870 REM
9880 REM  **** strip off leading spaces ****
9890 REM
9900 IF LEFT$(A$,1)=" " AND A$<>" " THEN A$=MID$(A$,2):GOTD 9900
9910 IF A$=" " THEN A$=""
9920 RETURN
9930 REM
9940 REM  **** convert to lower case ****
9950 REM
9960 B$="":IF A$="" TMEN RETURN
9970 FOR X%=1 TO LEN(A$):A%=ASC(MID$(A$,X%,1))
9980 IF A%>64 AND A%<91 TMEN A%=A%+32
9985 B$=B$+CHR$(A%)
9990 NEXT X%:RETURN
```

```
(* This is a file called TRAVEL.TXT, it can be created in WORDSTAR or any *)
(* text editor like EDLIN.                                                 *)

(* The TITLE line defines the heading that the RUN TIME program displays  *)
(* This TITLE line is optional.                                            *)
(* All the comments between '(*' and '*)' do not have to be typed in.      *)
(* All comments are ignored by the COMPILER program.                       *)

title='Demonstration Simple Expert System to determine best means of travel'

(* The DESCRIBE line is used in the run time program to describe the *)
(* attribute to the user. The VERB line is used to define the text   *)
(* that is put between the description and the value, and also to    *)
(* check that the rule part verb is correct.                         *)
(* E.g. If the value of 'travel' is 'by car' the RUN TIME program    *)
(* will display - the best means of travel is by car                 *)

define travel
  [
  describe='the best means of travel'
  verb='is'
  options='by foot,by car,by train,by plane'
  ]

(* With the ASK line present, the expert system will prompt the      *)
(* user for the information when it is needed.                       *)
(* The text in single quotes can be split up onto more than one line *)
(* if you put a '+' after the single quote at the end of the line    *)

define weather
  [
  describe='the weather outside'
  verb='is'
  options='nice and sunny,cold or wet'
  ask='What is the weather like now or likely to be '+
      'on the trip ?'
  ]

(* 'boolean' in the OPTION line limits the values of the attribute to *)
(* YES/TRUE or NO/FALSE. The brackets in the DESCRIBE line define the *)
(* text that is printed for the description. The text before the / is *)
(* printed if the value is true, the text after the / if it is false. *)
(* No VERB line is needed with the boolean option                     *)

define nice day
  [
  describe='the sun (is/is not) shining'
  options='boolean'
  ask='Is the sun shining and there are no clouds ?'
  ]

define cold day
  [
  describe='the day (is/is not) cold'
  options='boolean'
  ask='Is it cold outside ?'
  ]

define raining
  [
  describe='it (is/is not) raining'
  options='boolean'
  ask='Is it raining ?'
  ]

define snowing
  [
  describe='it (is/is not) snowing'
  options='boolean'
  ask='Is it snowing ?'
  ]

(* 'number' in the OPTION line means the value of the attribute is a number *)
(* The first number is the lower limit, the second number is the upper      *)
(* limit, the third parameter is the units for the number and is used when  *)
(* displaying the attribute information in the run time program. The two    *)
(* values are inclusive, so in this case 1 <= distance <= 10000             *)

define distance
  [
  describe='the distance to the destination'
  options='number,1,10000,miles'
  ask='What is the number of miles to the destination ?'
  ]

(* 'ok to walk' has no question with it, so when this information is needed *)
(* the system will have to find a rule that gives 'ok to walk' a value.     *)

define ok to walk
  [
  describe='walking to the destination (is/is not) ok'
  options='boolean'
  ]

define use of car
  [
  describe='you (can/cannot) use a car'
  options='boolean'
  ]

define able to drive
  [
  describe='you (can/cannot) drive'
  options='boolean'
  ask='Can you drive a car ?'
  ]
```

```
define access to car
  [
  describe='you (have/do not have) access to a car'
  options='boolean'
  ask='Do you own a car or have access to one for the trip ?'
  ]

define good parking
  [
  describe='the parking at the destination (is/is not) good'
  options='boolean'
  ask='Is the parking at destination good ?'
  ]

define on railway line
  [
  describe='the destination (is/is not) on a railway line'
  options='boolean'
  ask='Is the destination on a railway line ?'
  ]

define near airport
  [
  describe='the destination (is/is not) near an airport'
  options='boolean'
  ask='Is the destination near an airport ?'
  ]

define flying opinion
  [
  describe='your opinion of flying'
  verb='is'
  options='you like it,you do not mind it,you hate it'
  ask='What do you think of flying ?'
  ]

(* This is a file called TRAVEL.RUL, it can be created in WORDSTAR or any *)
(* text editor like EDLIN.                                                 *)

(* The rules file for the travel expert system.                            *)
(* The main attribute to be searched for is travel, although the program   *)
(* will calculate a value for any of the attributes given.                 *)

rule
  travel is by foot
  if ok to walk is true
  and weather is nice and sunny

rule
  travel is by car
  if distance < 500
  and use of car is true

rule
  travel is by train
  if distance < 500
  and on railway line is true

rule
  travel is by plane
  if distance >= 500
  and flying opinion is not you hate it
  and near airport is true

rule
  use of car is true
  if able to drive is true
  and access to car is true
  and good parking is true

rule
  use of car is false
  if able to drive is false

rule
  use of car is false
  if access to car is false

rule
  use of car is false
  if good parking is false

rule
  weather is nice and sunny
  if nice day is true
  and cold day is false

rule
  weather is cold or wet
  if cold day is true

rule
  weather is cold or wet
  if raining is true

rule
  weather is cold or wet
  if snowing is true

rule
  ok to walk is true
  if distance < 2

rule
  ok to walk is false
  if distance < 2
  and weather is cold or wet

rule
  ok to walk is false
  if distance >= 2
```

Commodore 64 Spoken Program

by Mike Horoszko

MICROTEX 666

Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

The program is first loaded into the computer and then the program you wish to develop is started in the normal way. If you wish to list this program to the Currah, just type GOTO 50000 and the Currah will tell you what to do. When you have finished with your development work, save the program in the normal way. The Currah program will be saved with your work program. When you come to resume work on the program, load it in the normal way and the Currah program will be ready to use. The only thing you have to watch for is that line numbers do not overwrite the Currah program. The disadvantage with this method is that you lose some available memory, but the benefits it brings to a blind person are independence and freedom to work with a computer.

The next stage in the development is a screendump, and also a routine to use the function keys to call the utility programs into operation. (I will also be looking into a method of developing a Braille and would be grateful for any suggestions.)

Line No 50010 LA=FNA(X)
The variable LA is the *line address* — that is, the start of a line in Basic. This is stored as a two-byte number, low-order, followed by the high-order part. The next two bytes in the memory are the low and high order bytes of the *next line address pointer.* This tells the computer where in memory the next line in Basic is stored.

Line No. 50011 LN=FNA(LA+2)
LN is the variable used for the line number used in Basic. It has to be (LA+2) in order to jump the location of the *next line address pointer.*

Line Nos 50017 SAY "LIST"
50018 FORN=1 TO 250: NEXT
50019 SAY "TYPE IN LINE NUMBERS OR REETERN"
These lines send the command SAY to the Currah speech synthesiser. It then operates on the words inside the quotation marks. Line 50018 is a simple time delay which is needed to give the speech a more realistic feel. The word REETERN has to be spelled this way so that the synthesiser pronounces it correctly.

Line No 50028 Z$=RIGHT$(S$,1): GOSUB 50079 : GOSUB 50081 : S$=LEFT$(S$,LEN(S$)−1) : GOTO 50020
This is the second and the most important part of the delete routine. After coming in from the line above, this line first assigns Z$ with the last character typed in by using the command Z$=RIGHT$(S$,1). This looks at the string S$ and then, because you are telling the computer to look at the right side of the string and only to look at one character, this character is assigned to Z$. It is then passed to the SAY routine at line 50079 which says Z$. The computer then GOs to the second subroutine at line 50081 which instructs the Currah speech synthesiser to say 'deleted'. Thus if you make a typing error, you can delete characters in the normal way and the Currah speech synthesiser will keep you in line so you know exactly where you are.

Line Nos 50034 IF SN=0 THEN B=A:GOTO 50040
50035 IF SN=1 THEN B=VAL (RIGHT$(S$,SL−1)): GOTO 50040
50036 IF SN=SL THEN 50040
50037 B=VAL (RIGHT$(S$, SL−SN))
These lines are used to check to see if

you have either one or two sets of numbers to work with. The first line looks to see if the flag SN is set to zero. If it is then we are only looking at one line number, so B is made to equal A. If SN, the minus flag, is set to 1, then we know that we have only the second number to work with and that the minus sign is at the start of the string.

By using the statement RIGHT$ (S$,SL−1) we can strip the minus sign off the front of the string. It is a simple task of taking the VAL of what's left to end up with the number required which is then sent off for processing. The next line checks to see if the minus sign is at the end of the string (IF SN=SL). If it is, we know the number we have is the first number only (A). If it is not, then we know that we are dealing with two numbers.

Line Nos 50040 IF LN>=A THEN 50042 50041 LA=FNA(LA):LN=FNA (LA+2): GOTO 50040

These two lines work together to ensure that the condition in line 50040 is correct. They are used to ensure that we are at the correct place in the memory where the line we wish to look at is stored.

Line No 50043 V=PEEK (T):IF V<> 19 ANDV < 32 THEN V=32

Here we start to pull out the information stored in the memory. We look at each location at a time and check to see if its value is less than 32 or if it's 19. All the codes under 32, apart from 19, are control codes and these are not wanted. The Currah speech synthesiser cannot handle most control codes. The only exception is code 19 which is the cursor home; this is needed and has to be filtered out. If the code is not 19 and is a control code, then I have made it equal the code 32 which is the ASCII code for a space.

Line No 50044 IF V > 127 THEN TEXT$=TEXT$ + RE$(V−127): GOTO 50063

All the key words used in the Basic language on the Commodore 64 are stored in a token form. These token words have ASCII codes greater than 127. It is a simple task of testing to see if there is a key word. If there is, then we need to extract that word from the stored directory. The data has been arranged so that its array subscripts follow on in the same way that the computer uses its tokens. Therefore, to get the correct key word in the array, subtract 127 from V to arrive at the correct subscript. After the key word has been extracted, we add it to the string TEXT$.

Line No 50064 IF V <> 0 THEN 50044

This line is used to look for the end-of-line marker which is a zero. If it is not found, then it is sent off to continue the process of looking at the line and forming the string TEXT$. If it is found, then we are at the end of the line and it can be sent to the Currah speech synthesiser.

Line No 50065 IF SP% < 200 THEN 50065

The Currah can only take a limited number of words before its buffer is full. By using this statement, a delay can be introduced to ensure that we do not overflow the unit. The Currah uses SP% as a variable, which changes as its speech buffer fills. By making the computer repeat the same line until the buffer is below 200, we can ensure that we do not lose any of the text in the string.

Line Nos 50067 GET Z$:IFZ$="" THEN 50067 50068 IF Z$=CHR$(13) THEN END 50069 IF Z$ = CHR$(32) THEN 50066 50070 LA = FNA(LA) 50071 LN = FNA(LA +2) 50072 IF LN > B OR LN > 49999 THEN END 50073 GOTO 50042

At this stage it was found that some kind of control over the listing was needed. This section does this. The first three lines input a character and then test it. If the character is the Return Key (ASCII 13), then the listing is terminated and you return to the program under development. If the character is the Space Bar Key (ASCII 32), the program is sent back to line 50066 and that line will be repeated. If any other character is pressed, the program proceeds on to the next line.

```
49999 END
50000 REM PROGRAM FOR THE CURRAH SPEECH SINTH.
50001 REM
50002 REM WRITTEN BY MIKE HOROSZKO
50003 REM
50004 REM 15:4:1985
50005 REM
50006 DIM RE$(128)
50007 RE$(128)="'PIE."
50008 X=43:INIT
50009 DEF FNA(X)=PEEK(X+1)*256+PEEK(X)
50010 LA=FNA(X)
50011 LN=FNA(LA+2)
50012 FOR Z=1 TO 90
50013 READ RE$(Z)
50014 NEXT
50015 A=0:B=49999:Z=0
50016 S$=""
50017 SAY"LIST"
50018 FOR N=1TO250:NEXT
50019 SAY"TYPE IN LINE NUMBERS OR REETERN"
50020 GET A$:IF A$="" THEN 50020
50021 IF A$=CHR$(13) THEN GOSUB 50075:GOTO 50029
50022 IF A$="-" THEN Z=Z+1
50023 IF Z>1 THEN GOSUB 500B3:Z=1:GOTO 50020
50024 IF ((A$>="0") AND (A$<="9")) OR A$="-" OR A$=CHR$(20)
      THEN GOTO 50026
50025 GOSUB 500B3:GOTO 50020
50026 IF A$ <> CHR$(20) THEN S$=S$+A$:GOSUB 50077:GOTO 50020
50027 IF LEN(S$)=0 THEN 50020
50028 Z$=RIGHT$(S$,1):GOSUB 50079:GOSUB 50081:S$=LEFT$(S$,LEN(S$)-1)
      :GOTO 50020
50029 A=VAL(S$)
50030 SL=LEN(S$):IF SL=0 THEN 50040
50031 FOR I=1 TO SL
50032 IF MID$(S$,I,1)="-" THEN SN=I
50033 NEXT
50034 IF SN=0 THEN B=A:GOTO 50040
50035 IF SN=1 THEN B=VAL(RIGHT$(S$,SL-1)):GOTO 50040
50036 IF SN=SL THEN 50040
50037 B=VAL(RIGHT$(S$,SL-SN))
5003B IF A>B THEN GOSUB 50083:GOTO 50015
50040 IF LN>=A THEN 50042
50041 LA=FNA(LA):LN=FNA(LA+2):GOTO 50040
50042 T = LA+3:TEXT$=STR$(LN)+" "
50043 V=PEEK(T):IF V<>19 AND V<32 THEN V=32
50044 IF V>127 THEN TEXT$=TEXT$ + RE$(V-127):GOTO 50063
50045 C$=CHR$(V)
50046 IF C$="?" THEN C$=" 'QUESTCHON. "
50047 IF C$="←" THEN C$=" 'ARROW LEFT. "
50048 IF C$="↑" THEN C$=" 'EXKLEMMAISHON. "
50049 IF C$=CHR$(34) THEN C$=" 'QUOTE. "
50050 IF C$="£" THEN C$=" 'POUND. "
50051 IF C$=";" THEN C$=" 'SEMMEE [C(OO)LON] "
50052 IF C$=":" THEN C$=" '[C(OO)LON] "
50053 IF C$="S" THEN C$=" 'HOME. "
50054 IF C$="'" THEN C$=" 'APOSTOOOFEE. "
50055 IF C$=" " THEN C$=" 'SPACE. "
50056 IF C$="," THEN C$=" 'COMMER. "
50057 IF C$="." THEN C$=" 'POINT. "
50058 IF C$="(" THEN C$=" 'OPEN BRACKET. "
50059 IF C$=")" THEN C$=" 'CLOSE BRACKET. "
50060 IF C$="[" THEN C$=" 'OPEN SQUERE BRACKET. "
50061 IF C$="]" THEN C$=" 'CLOSE SQUERE BRACKETS. "
50062 TEXT$=TEXT$+C$
50063 T=T+1:V=PEEK(T)
50064 IF V<>0 THEN 50044
50065 IF SP%< 200 THEN 50065
50066 SAY TEXT$
50067 GET Z$:IF Z$=""THEN 50067
5006B IF Z$=CHR$(13) THEN END
50069 IF Z$=CHR$(32) THEN 50066
50070 LA=FNA(LA)
50071 LN=FNA(LA+2)
50072 IF LN>B OR LN>49999 THEN END
50073 GOTO 50042
50075 SAY "REETERN"
50076 RETURN
50077 SAY A$
50078 RETURN
50079 SAY Z$
50080 RETURN
500B1 SAY "DELEATED"
50082 RETURN
50083 SAY"YOU HAVE ERRORD TYPE IN AGAIN"
50084 RETURN
500B5 DATA 'END.
50086 DATA 'FOR.
50087 DATA 'NEXT.
```

```
 50088 DATA 'DAITA.
 50089 DATA 'INPUT #.
 50090 DATA 'INPUT.
 50091 DATA 'DIMENTION.
 50092 DATA 'REED.
 50093 DATA 'LET.
 50094 DATA 'GO TU.
 50095 DATA 'RUN.
 50096 DATA 'IF.
 50097 DATA 'REESTORE.
 50098 DATA 'GO [SSUU(B)]'
 50099 DATA 'REETERN.
 50100 DATA '[R(EH)M]'
 50101 DATA 'STOP.
 50102 DATA 'ON.
 50103 DATA 'WAIT.
 50104 DATA 'CLEAR SKREEN.
 50105 DATA 'SAVE.
 50106 DATA '[V(I)RIF(II)]'
 50107 DATA 'DEEFINE.
 50108 DATA 'POKE.
 50109 DATA 'PRINT #.
 50110 DATA 'PRINT.
 50111 DATA 'CONTINUE.
 50112 DATA 'LIST.
 50113 DATA 'CLEAR VERIBUL.
 50114 DATA 'COMAND.
 50115 DATA 'SYSTEM.
 50116 DATA 'OPEN.
 50117 DATA 'CLOSE.
 50118 DATA '[(GGG)E(TT)]'
 50119 DATA 'NEW.
 50120 DATA 'TAV.OPEN BRACKET.
 50121 DATA 'TU.
 50122 DATA 'FUNCTION.
 50123 DATA 'SPACE. OPEN BRACKET.
 50124 DATA 'THEN.
 50125 DATA 'NOT.
 50126 DATA 'STEP.
 50127 DATA 'PLUS.
 50128 DATA 'MYNUS.
 50129 DATA 'MULTYPLY BY.
 50130 DATA 'DEVIDED BY.
 50131 DATA 'ARROW UP.
 50132 DATA 'AND.
 50133 DATA 'OR.
 50134 DATA 'GRATER THAN.
 50135 DATA 'EEQUULS.
 50136 DATA 'LESS THAN.
 50137 DATA 'S G N'
 50138 DATA 'INTERJER.
 50139 DATA 'ABSOLUTE.
 50140 DATA '[(OU)S(ER)]'
 50141 DATA 'FREE.
 50142 DATA 'POSITION.
 50143 DATA 'SQRERE ROOT.
 50144 DATA 'RANDUM.
 50145 DATA '[LO(GGG)]'
 50146 DATA 'EXPONENSHAL.
 50147 DATA 'COSINE.
 50148 DATA 'SINE.
 50149 DATA 'TANJUNT.
 50150 DATA 'ARC.TANJUNT.
 50151 DATA 'PEEK.
 50152 DATA 'LENTH.
 50153 DATA '$ T R $'
 50154 DATA 'VALUE.
 50155 DATA 'ASKEY.
 50156 DATA 'C H R $'
 50157 DATA 'LEFT$'
 50158 DATA 'RIGHT$'
 50159 DATA 'MID$'
 50160 DATA 'CRAP.
 50161 DATA 'D OPEN.
 50162 DATA 'D CLOSE.
 50163 DATA 'REECORD.
 50164 DATA 'HHEDDER.
 50165 DATA 'COLLECT.
 50166 DATA 'BACKUP.
 50167 DATA 'COPY.
 50168 DATA 'AHPEND.
 50169 DATA 'D SAVE.
 50170 DATA 'D LOAD.
 50171 DATA 'CATALOG.
 50172 DATA 'RENAME.
 50173 DATA 'SCRATCH.
 50174 DATA 'DIRECTOREE.

READY.
```

Spectrum Kaleidoscope

by Alan Wakeman

This program demonstrates how complicated, colourful and changing graphics displays can be created on the Spectrum.

Full instructions are included in the program, and it is fairly easy to work out how it works and achieves its spectacular effects.

```
 10 REM "Kaleidoscope"     Alan Wakeman 1985          **********
 20
 30 REM Initialise
 40 INVERSE 0: OVER 0: BRIGHT 0: FLASH 0: RANDOMIZE 0
 50
 60 REM Set Graphics
 70 GO SUB 1000
 80
 90 REM Opening Screen
100 GO SUB 1200
110
120 REM Background Colour Loop
130 FOR k=1 TO 7
140 BORDER k: PAPER k: CLS
150
160 REM Paper Over Loop
170 FOR o=0 TO 1
180 OVER o
190
200 REM Inverse Loop
210 FOR i=0 TO 1
220 INVERSE i
230
240 REM Paper Colour Loop
250 FOR p=0 TO 7
260 PAPER p
270
280 REM Select Graphics
290 GO SUB 1600
300
310 REM Main Painting Loop
320 LET x=INT (RND*15.999)
330 LET y=10
340 IF x>=0 AND x<=7 THEN  LET h=1
350 IF x>=8 AND x<=15 THEN  LET h=-1
360 LET v=-1
370 LET q=INT (RND*300)+26
380 FOR l=0 TO q
390 INK INT (RND*7.999)
400 BRIGHT INT (RND*1.1)
410
420 REM I/A Colour
430 IF INKEY$="1" THEN  INK 1
440 IF INKEY$="2" THEN  INK 2
450 IF INKEY$="3" THEN  INK 3
460 IF INKEY$="4" THEN  INK 4
470 IF INKEY$="5" THEN  INK 5
480 IF INKEY$="6" THEN  INK 6
490 IF INKEY$="7" THEN  INK 7
500 IF INKEY$="0" THEN  INK 0
510
520 REM I/A Design
530 IF INKEY$="D" OR INKEY$="d" THEN  GO SUB 1600
540
550 REM I/A Stop
560 IF INKEY$="S" OR INKEY$="s" THEN  GO SUB 1400
570
580 LET m=31
590 LET n=21
600 PRINT AT y,x;CHR$ (a)
610 PRINT AT y,m-x;CHR$ (b)
620 PRINT AT n-y,x;CHR$ (c)
630 PRINT AT n-y,m-x;CHR$ (d)
640 LET x=x+h
650 LET y=y+v
660 IF x=0 OR x=31 THEN  LET h=-h
670 IF y=0 OR y=21 THEN  LET v=-v
680 NEXT l
690 NEXT p
700 NEXT i
710 NEXT o
720 NEXT k
730 GO TO 130
740
970 REM SUBROUTINES                    ******************************
980
990 REM Set Graphics
1000 FOR z=144 TO 164
1010 FOR w=0 TO 7
1020 READ e
1030 POKE USR CHR$ (z)+w,e
1040 NEXT w
1050 NEXT z
1060 RETURN
1070
1190 REM Opening Screen
1200 BORDER 1: PAPER 1: INK 7: CLS
1210 PLOT 10,156: DRAW 230,0: DRAW 0,-48: DRAW -230,0: DRAW 0,48
1220 FOR r=12 TO 21: PRINT AT r,0; PAPER 7;"
     "; NEXT r
1230 PRINT AT 8,5; PAPER 1;" Alan Wakeman 1985 "
1240 PAPER 7: INK 0: PRINT AT 13,1;"The following keys are
     active:";AT 15,0; INK 1;"0-7 (COLOUR keys)";AT 16,6;"D
     (CHANGES DESIGN)";AT 17,6;"S   (STOPS programme)";AT 18,6;"R
```

```
(RESTARTS it)";AT 20,3; INK 2;"Press any key to begin..."
1250 FOR p=1 TO 7
1260 PRINT AT 4,2; PAPER p; INK 9;"          ";AT 5,2;"  K A L
E I D O S C O P E  ";AT 6,2;"          "
1270 IF INKEY$="" THEN  GO TO 1290
1280 RETURN
1290 PAUSE 9: NEXT p: GO TO 1250
1300
1390 REM I/A Stop
1400 FOR a=0 TO 1
1410 LET a=0
1420 IF INKEY$="r" OR INKEY$="R" THEN  LET a=1
1430 NEXT a
1440 RETURN
1450
1590 REM Select Graphics Pointer
1600 LET g=INT (RND*8.999)+2
1610 IF g<=8 THEN  GO SUB g*1000
1620 IF g=9 THEN  GO SUB 2500
1630 IF g=10 THEN  GO SUB 3500
1640 RETURN
1650
1990 REM Selects Graphics
2000 LET a=144
2010 LET b=145
2020 LET c=146
2030 LET d=147
2040 RETURN
2050
2500 LET a=160
2510 LET b=161
2520 LET c=162
2530 LET d=163
2540 RETURN
2550
3000 LET a=150
3010 LET b=152
3020 LET c=153
3030 LET d=151
3040 RETURN
3050
3500 LET a=164
3510 LET b=164
3520 LET c=164
3530 LET d=164
3540 RETURN
3550
4000 LET a=148
4010 LET b=148
4020 LET c=148
4030 LET d=148
4040 RETURN
4050
5000 LET a=149
5010 LET b=149
5020 LET c=149
5030 LET d=149
5040 RETURN
5050
6000 LET a=154
6010 LET b=155
6020 LET c=155
6030 LET d=154
6040 RETURN
6050
7000 LET a=156
7010 LET b=157
7020 LET c=157
7030 LET d=156
7040 RETURN
7050
8000 LET a=158
8010 LET b=159
8020 LET c=159
8030 LET d=158
8040 RETURN
8050
8990 REM Graphics Data
9000 DATA 3,15,31,63,127,127,255,255
9010 DATA 192,240,248,252,254,254,255,255
9020 DATA 255,255,127,127,63,31,15,3
9030 DATA 255,255,254,254,252,248,240,192
9040 DATA 255,231,195,129,129,195,231,255
9050 DATA 24,60,126,255,255,126,60,24
9060 DATA 255,254,252,248,240,224,192,128
9070 DATA 1,3,7,15,31,63,127,255
9080 DATA 255,127,63,31,15,7,3,1
9090 DATA 128,192,224,240,248,252,254,255
9100 DATA 240,224,192,128,1,3,7,15
9110 DATA 15,7,3,1,128,192,224,240
9120 DATA 192,192,252,252,63,63,3,3
9130 DATA 3,3,63,63,252,252,192,192
9140 DATA 1,2,4,8,16,32,64,128
9150 DATA 128,64,32,16,8,4,2,1
9160 DATA 3,12,16,32,64,64,128,128
9170 DATA 192,48,8,4,2,2,1,1
9180 DATA 128,128,64,64,32,16,12,3
9190 DATA 1,1,2,2,4,8,48,192
9200 DATA 24,24,24,255,255,24,24,24
```

Amstrad Pascal GRAPHLIB

by Robin Shipp

This program is a library of routines written in Hisoft Pascal for the Amstrad CPC 464. It is intended for use in scientific/mathematic programs requiring graphical output, but could also be used to produce business charts or graphs. When tne routines that make up GRAPHLIB are used, real coordinates should be used, rather than the computer's. This means that if you want to plot a graph to display data between, say, −2 and 5, then these values should be used rather than screen coordinates. This is set up by the initialising routine, GSTART, which specifies the user's coordinates for the bottom-left and top right-hand corners of the graphics window.

When the GRAPHLIB routines have been entered and checked, they should be saved as the file GRAPHLIB.PAS. This can then be included in the user's program using $F just after the VAR declarations. GRAPHLIB includes the global variables used by the routines. The example program gives a demonstration of how the routines should be used.

```
1000 {    Graphics Library - Graphlib.pas
1010       (c) Robin Shipp 1985 }
1020
1030 {$i-}
1040
1050   { Global Variables  }
1060  gxr,gyr,          {Current position IN user's coordinates}
1070  gxc,gxm,gyc,gym, {Values FOR 'transform' }
1080 ,gxmin,gxmax,gymin,gymax {Limits OF graphics window IN
1090                          user's coordinates}
1100       :real;
1110
1120 PROCEDURE gtext(switch:boolean);
1130
1140 {  switch = true : text at graphics cursor on
1150    switch = false: text at graphics cursor off}
1160
1170 BEGIN
1180  ra:=chr(ord(switch));
1190  user(#bb63)  {TXTSETGRAPHIC}
1200  END;
1210
1220 PROCEDURE gwindow(left,right,top,bottom:integer);
1230
1240 {  Sets size OF graphics window
1250    Arguments are IN pixel coordinates}
1260
1270 BEGIN
1280  rde:=right; rhl:=left;
1290  user(#bbcf); {GRAWINWIDTH}
1300  rde:=top; rhl:=bottom;
1310  user(#bbd2)  {GRAWINHEIGHT}
1320  END;
1330
1340 PROCEDURE gclear;
1350
1360 {  Clears graphics window}
1370
1380 BEGIN
1390  user(#bbdb)  {GRACLEARWINDOW}
1400  END;
1410
1420 PROCEDURE gpen(ink:integer);
1430
1440 {  Sets ink FOR graphics pen}
1450
1460 BEGIN
1470  ra:=chr(ink);
1480  user(#bbde)  {GRASETPEN}
1490  END;
1500
1510 PROCEDURE gpaper(ink:integer);
1520
1530 {  Sets ink FOR graphics paper}
1540
1550 BEGIN
1560  ra:=chr(ink);
1570  user(#bbe4)  {GRASETPAPER}
1580  END;
1590
1600 PROCEDURE mode(m:integer);
1610
1620 {  Sets screen mode}
1630
```

```
1640 BEGIN
1650  ra:=chr(m);
1660  user(#bc0e)  {SCRSETMODE}
1670  END;
1680
1690 PROCEDURE setink(ink,colour1,colour2:integer);
1700
1710 {  Sets ink - both colours same -> steady
1720                different colours -> flashing}
1730
1740 BEGIN
1750  ra:=chr(ink); rb:=chr(colour1); rc:=chr(colour2);
1760  user(#bc32)  {SCRSETINK}
1770  END;
1780
1790 PROCEDURE transform(x,y:real;VAR xp,yp:integer);
1800
1810 {  Converts user's coordinates (x,y) into
1820    pixel coordinates (xp,yp) - internal
1830    use only}
1840
1850 BEGIN
1860  xp:=round(gxc+gxm*x);
1870  yp:=round(gyc+gym*y)
1880  END;
1890
1900 PROCEDURE move(x,y:real);
1910
1920 {  Moves TO (x,y) }
1930
1940 VAR
1950  xp,yp:integer;
1960
1970 BEGIN
1980  gxr:=x; gyr:=y;
1990  transform(x,y,xp,yp);
2000  rde:=xp; rhl:=yp;
2010  user(#bbc0)  {GRAMOVEABSOLUTE}
2020  END;
2030
2040 PROCEDURE rmove(dx,dy:real);
2050
2060 {  Moves by (dx,dy) relative TO current position}
2070
2080 BEGIN
2090  move(gxr+dx,gyr+dy)
2100  END;
2110
2120 PROCEDURE rdraw(dx,dy:real;line:integer);
2130
2140 FORWARD;
2150
2160 PROCEDURE draw(x,y:real;line:integer);
2170
2180 {  Draws line from current position TO (x,y)
2190      line = 0 : unbroken line
2200      line > 0 : dashed line, higher number -> longer dashes}
2210
2220 VAR
2230  i,np,xp,yp:integer;
2240  dx,dy,xi,yi:real;
2250
2260 BEGIN
2270  IF line<1 THEN BEGIN
2280   transform(x,y,xp,yp);
2290   rde:=xp; rhl:=yp;
2300   user(#bbf6); {GRALINEABSOLUTE}
2310   gxr:=x; gyr:=y
2320   END
2330  ELSE BEGIN
2340   dx:=x-gxr; dy:=y-gyr;
2350   np:=round((sqrt(sqr(gxm*dx)+sqr(gym*dy)))/(8*line));
2360   xi:=0.5*dx/np; yi:=0.5*dy/np;
2370   FOR i:=1 TO np DO BEGIN
2380    rdraw(xi,yi,0);
2390    rmove(xi,yi)
2400    END;
2410   draw(x,y,0)
2420   END
2430  END;
2440
2450 PROCEDURE rdraw;
2460
2470 {  Draws line from current position TO (dx,dy)
2480    relative TO it
2490    See 'draw' FOR action OF 'line' }
2500
2510 BEGIN
2520  draw(gxr+dx,gyr+dy,line)
2530  END;
2540
2550 PROCEDURE gstart(xmin,ymin,xmax,ymax:real);
2560
2570 {  1.  Initialises such that, IN user's coordinates,
2580         (xmin,ymin) is bottom left OF graphics window
2590         AND (xmax,ymax) is top right
2600
2610     2.  Sets TO blue pen on yellow paper
2620
2630     3.  Clears graphics window
2640
2650     4.  Sets current point TO centre OF window}
2660
2670 VAR
2680  left,right,top,bottom:integer;
2690
2700 BEGIN
2710  setink(1,24,24); setink(0,1,1);
2720  gpen(0); gpaper(1); gclear;
2730  user(#bbd5); {GRAGETWWIDTH}
2740  left:=rde; right:=rhl;
2750  user(#bbd8); {GRAGETWHEIGHT}
2760  top:=rde; bottom:=rhl;
2770  gxm:=(right-left)/(xmax-xmin);
2780  gxc:=left-gxm*xmin;
2790  gym:=(top-bottom)/(ymax-ymin);
2800  gyc:=bottom-gym*ymin;
2810  move(0.5*(xmax+xmin),0.5*(ymax+ymin));
2820  gxmin:=xmin; gxmax:=xmax;
2830  gymin:=ymin; gymax:=ymax
2840  END;
2850
2860 PROCEDURE axes(xdiv,ydiv:real;
2870   xfield,xdecpl,yfield,ydecpl:integer);
2880
2890 {  Draws axes along x=0 AND y=0 WITH ticks at intervals
2900    OF xdiv AND ydiv along x AND y axes, respectively
2910
2920    Labels axes WITH x AND y values at each tick, written
2930    IN field OF xfield AND yfield, AND WITH xdecpl AND
2940    ydecpl decimal places, respectively
2950
2960    Note: field <1 disables labelling OF axis }
2970
2980 VAR
2990  mode,charsize,xshift,yshift:integer;
3000  ticklength:real;
3010
3020 BEGIN
3030  gtext(true);
3040  user(#bc11); {SCRGETMODE}
3050  mode:=ord(ra);
3060  CASE (mode) OF
3070   0: charsize:=32;
3080   1: charsize:=16;
3090   2: charsize:=8
3100   END;
3110  ticklength:=0.04*(gymax-gymin);
3120  xshift:=-(xfield*charsize) DIV 2; yshift:=-4;
3130  move(0,0);
3140  WHILE (gxr<gxmax) DO BEGIN
3150   rdraw(xdiv,0,0);
3160   rdraw(0,ticklength,0);
3170   rmove(0,-ticklength);
3180   IF (xfield>1) THEN BEGIN
3190    rde:=xshift; rhl:=yshift;
3200    user(#bbc3); {GRAMOVERELATIVE}
3210    write(gxr:xfield:xdecpl);
3220    move(gxr,gyr)
3230    END
3240   END;
3250  move(0,0);
3260  WHILE (gxr>gxmin) DO BEGIN
3270   rdraw(-xdiv,0,0);
3280   rdraw(0,ticklength,0);
3290   rmove(0,-ticklength);
3300   IF (xfield>1) THEN BEGIN
3310    rde:=xshift; rhl:=yshift;
3320    user(#bbc3); {GRAMOVERELATIVE}
3330    write(gxr:xfield:xdecpl);
3340    move(gxr,gyr)
3350    END
3360   END;
3370  ticklength:=0.04*(gxmax-gxmin);
3380  xshift:=-(yfield*charsize)-4; yshift:=8;
3390  move(0,0);
3400  WHILE (gyr<gymax) DO BEGIN
3410   rdraw(0,ydiv,0);
3420   rdraw(ticklength,0,0);
3430   rmove(-ticklength,0);
3440   IF (yfield>1) THEN BEGIN
3450    rde:=xshift; rhl:=yshift;
3460    user(#bbc3); {GRAMOVERELATIVE}
3470    write(gyr:yfield:ydecpl);
3480    move(gxr,gyr)
3490    END
3500   END;
3510  move(0,0);
3520  WHILE (gyr>gymin) DO BEGIN
3530   rdraw(0,-ydiv,0);
3540   rdraw(ticklength,0,0);
3550   rmove(-ticklength,0);
3560   IF (yfield>1) THEN BEGIN
3570    rde:=xshift; rhl:=yshift;
3580    user(#bbc3); {GRAMOVERELATIVE}
3590    write(gyr:yfield:ydecpl);
3600    move(gxr,gyr)
3610    END
3620   END;
3630  gtext(false)
3640  END;
3650
3660 PROCEDURE gchar(c:char);
3670 {  Writes single character at current position
3680
3690    Current position reset ready TO write next character}
3700
3710
3720 VAR
3730  xp,yp:integer;
3740
3750 BEGIN
3760  ra:=c;
3770  user(#bbfc); {GRAWCHAR}
3780  user(#bb06); {GRAA8KCURSOR}
3790  xp:=rde; yp:=rhl;
3800  gxr:=(xp-gxc)/gxm;
3810  gyr:=(yp-gyc)/gym
3820  END;
3830
3840 PROCEDURE plot(x,y:real;point:integer);
3850
3860 {  Plots point centered on (x,y)
3870    'point' is ascii value OF character TO be plotted
3880      (most useful values are 159,202,203,227,230,
3890        232,233,244,245)
3900
3910    Note: IF point<32, pixel is plotted}
3920
3930 VAR
3940  ascii,xp,yp,mode,offset:integer;
3950
```

```
BEGIN
 ascii:=point MOD 256;
 IF (ascii<32) THEN BEGIN
  gxr:=x; gyr:=y;
  transform(x,y,xp,yp);
  rde:=xp; rhi:=yp;
  user(#bbea)  {GRAPLOTABSOLUTE}
  END
 ELSE BEGIN
  move(x,y);
  user(#bc11); {SCRGETMODE}
  mode:=ord(ra);
  CASE (mode) OF
   0: offset:=-16;
   1: offset:=-8;
   2: offset:=-4
   END;
  rde:=offset; rhl:=8;
  user(#bbc3); {GRAHOVERELATIVE}
  gchar(chr(ascii));
  move(x,y)
  END
 END;

PROCEDURE rplot(dx,dy:real;point:integer);

{  Plots point at (dx,dy) relative TO current position

   See 'plot' FOR action OF 'point' }

BEGIN
 plot(gxr+dx,gyr+dy,point)
 END;

($1+)

```

```
PROGRAM grdemol;

{  Demonstration PROGRAM FOR Graphics Library

   Draws curves OF y=x^2 AND y=x^3

      (c) Robin Shipp 1985}

VAR
 xi,yi:real;

   {$f graphlib.pas}

BEGIN   {Main PROGRAM}
 mode(1);
 gwindow(150,639,399,0);
 gstart(-2.1.-10.5,2.1,10.5);
 setink(2,13,13); setink(3,26,26);
 gpaper(2); gclear;
 axes(1.0,2.0,2.0,3,0);
 move(1.8,-0.75); gchar('X');
 sove(-0.25,9.5); gchar('Y');
 gpen(3); xi:=-2.0; yi:=4.0;
 sove(xi,yi);
 WHILE (xi<2.0) DO BEGIN
  xi:=xi+0.25; yi:=sqr(xi);
  draw(xi,yi,0)
  END;
 move(-1.8,4.2);
 gtext(true); write('Y=X^2'); gtext(false);
 xi:=-2.0; yi:=-8.0;
 move(xi,yi);
 WHILE (xi<2.0) DO BEGIN
  xi:=xi+0.25; yi:=xi*sqr(xi);
  draw(xi,yi,3)
  END;
 move(-1.8,-8.0);
 gtext(true); write('Y=X^3'); gtext(false)
 END.
```

Commodore 64 Polyphonic 64

by Jonathan Wadie

MICROTEX 666

Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

All the instructions for this program are contained within it. Suffice it to say that the program is a polyphonic synthesiser program which allows three different notes to be played at once. It has eight pre-programmed instruments and also allows you to program your own.

Full instructions for use are contained within the program.

```
0 REM ************************************
1 REM *         POLYPHONIC  64           *
2 REH *          BY JON WADIE            *
3 REM *     RED BARON SOFTWARE 1985      *
4 REM ************************************
5 PRINT"":AD=00B:SR=035:PL=000:PH=00B
6 GOTO120
9 PRINT""
10 PRINT"                                    "
15 PRINT"       _     |__      |__    |__    ";
20 PRINT"                                    "
25 PRINT"                                    ";
30 PRINT"                                    ";
35 PRINT"                                    "
40 PRINT"                                    ";
45 PRINT"|  |  |  |  |  |  |  |  |  |  |  |  |";
50 PRINT"| Q | W | E | R | T | Y | U | I | O | P | @ | * | ↑ |";
55 PRINT"____________________________________";
70 PRINT"F1: TRIANGLE WAVEFORM"
80 PRINT"F3: SAWTOOTH WAVEFORM"
90 PRINT"F5:. PULSE WAVEFORM"
100 PRINT"F7: MENU"
101 PRINT
102 RETURN
120 IFPEEK(49152)=32ANDPEEK(49153)=93THENGOTO300
130 FORC=49152TO49655STEP8:CK=C-256*INT(C/256):FORCC=0TO7:READM
     :CK=(CK+M)AND255
 140 POKEC+CC,M:NEXT
 150 IF(PEEK(63)+256*PEEK(64))<>CTHENPRINT"LINE"C" MISSING"
     :POKE49152,96:END
160 READM:IFM<>CKTHEN210
170 NEXT:GOTO300
180 POKE49278,AD:POKE49289,SR
190 POKE49256,PL:POKE49267,PH
200 SYS49152:GOTO300
210 PRINT"ERROR IN LINE"PEEK(63)+256*PEEK(64):POKE49152,96:END
299 REM *********MAIN MENU**************
300 PRINT"┌────┐"
301 PRINT"|MENU|"
302 PRINT"└────┘"
310 PRINT"SELECT SOUND (1)"
312 PRINT"CREATE SOUND (2)"
314 PRINT"KEYBOARD     (3)"
316 PRINT"INSTRUCTIONS (4)"
318 PRINT"QUIT PROGRAH (5)"
330 INPUT"SELECT NUMBER REQUIRED ";SN
335 IFSN<1ORSN>5THEN330
340 IFSN=1THENGOSUB500:GOSUB9:GOTO180
341 IFSN=2THENGOSUB400:GOSUB9:GOTO180
342 IFSN=3THENGOSUB9:GOTO180
```

```
343 IFSN=4THENGOTO600
344 IFSN=5THENGOTO345
345 INPUT" QUIT PROGRAM : ARE YOU SURE (Y/N) ";Q$
349 PRINT""
350 IFQ$="Y"THENPRINT"":NEW
351 IFQ$="N"THEN300
399 REM *********CREATE SOUND**********
400 PRINT"CREATE SOUND"
405 PRINT"  THE SETTINGS WERE:-"
409 PRINT"          ┌────────────────┬──────┐"
410 PRINT"          | ATTACK/DECAY   | ";AD;TAB(31);"|"
411 PRINT"          ├────────────────┼──────┤"
412 PRINT"          | SUSTAIN/RELEASE | ";SR;TAB(31);"|"
413 PRINT"          ├────────────────┼──────┤"
414 PRINT"          |   LOW PULSE    | ";PL;TAB(31);"|"
415 PRINT"          ├────────────────┼──────┤"
416 PRINT"          |   HI PULSE     | ";PH;TAB(31);"|"
417 PRINT"          └────────────────┴──────┘"
420 PRINT"  NOW ENTER NEW VALUES FOR:-"
460 INPUT"       ATTACK/DECAY (000-255) ";AD
461 IFAD<000ORAD>255THENPRINT"":GOTO460
465 INPUT"       SUSTAIN/RELEASE (000-255) ";SR
466 IFSR<000ORSR>255THENPRINT"":GOTO465
470 INPUT"       LO PULSE (000-200) ";PL
471 IFPL<000ORPL>200THENPRINT"":GOTO470
475 INPUT"       HI PULSE (000-200) ";PH
476 IFPH<000ORPH>200THENPRINT"":GOTO475
498 RETURN
499 REM *********SOUND MENU************
500 PRINT"SOUND MENU"
501 PRINT"INSTRUMENT              WAVEFORM    NO."
502 PRINT"──────────              ────────    ───"
510 PRINT"PIANO                [TRIANGLE]    (1)"
511 PRINT"FLUTE                [TRIANGLE]    (2)"
512 PRINT"HARPSICHORD          [SAWTOOTH]    (3)"
513 PRINT"WOODWIND             [TRIANGLE]    (4)"
514 PRINT"ORGAN                [TRIANGLE]    (5)"
515 PRINT"BANJO                [ PULSE  ]    (6)"
516 PRINT"ACCORDIAN            [TRIANGLE]    (7)"
517 PRINT"TRUMPET              [SAWTOOTH]    (8)"
540 INPUT"ENTER CHOICE";C
541 IFC<0ORC>8THEN540
545 IFC=1THENAD=9:SR=2:PL=200:PH=0:RETURN
546 IFC=2THENAD=96:SR=15:PL=0:PH=1:RETURN
547 IFC=3THENAD=9:SR=3:PL=0:PH=1:RETURN
548 IFC=4THENAD=135:SR=9:PL=0:PH=1:RETURN
549 IFC=5THENAD=0:SR=240:PL=0:PH=1:RETURN
550 IFC=6THENAD=9:SR=5:PL=200:PH=2:RETURN
551 IFC=7THENAD=102:SR=0:PL=1:PH=0:RETURN
552 IFC=8THENAD=96:SR=10:PL=3:PH=4:RETURN
598 RETURN
```

```
599 REM ********INSTRUCTIONS***********
600 PRINT"
601 PRINT"
602 POKE53272,23
605 PRINT" HIS PROGRAM ALLOWS YOU TO USE ONE OF  ";
606 PRINT" 8  PRE-DEFINED SOUNDS OR TO CREATE YOUR";
607 PRINT"OWN SOUNDS. HE KEYBOARD IS POLYPHONIC,  ";
608 PRINT"THIS MEANS YOUR CAN PLAY UP TO 3 NOTES  ";
609 PRINT"AT A TIME"
610 PRINT
611 PRINT" HERE ARE 3 MAIN OPTIONS:-              ";
612 PRINT:PRINT" (1) ELECT SOUND.....HIS ALLOWS YOU TO";
613 PRINT"CHOOSE ONE OF THE PRESET SOUNDS.  HE    ";
614 PRINT"WAVEFORM TELLS YOU WHICH KEY TO PRESS   ";
615 PRINT"WHEN YOU ARE IN THE KEYBOARD MODE.      ";
616 PRINT" (2) REATE SOUND.....HIS ALLOWS YOU TO";
617 PRINT"DEFINE YOUR OWN SOUNDS BY MODIFYING THE ";
618 PRINT"/ / / AND THE WAVEFORMS.                ";
619 PRINT" (3) EYBOARD.....HIS ALLOWS YOU TO USE";
620 PRINT"NEARLY 2 OCTAVES,USING THE DISPLAYED    ";
621 PRINT"KEYS. HE FUNCTION KEYS LET YOU CHANGE   ";
622 PRINT"WAVEFORM WHILE YOU ARE PLAYING."
623 PRINT:PRINT"
625 GETK$:IFK$=""THEN625
626 POKE53272,21:GOTO300
49151 REM ****MACMINE CODE DATA*********
49152 DATA32,93,192,32,28,192,32,169,2
49160 DATA192,32,1,193,162,50,160,0,30
49168 DATA136,208,253,202,208,250,32,199,224
49176 DATA193,76,3,192,120,162,7,169,178
49184 DATA127,141,0,220,72,173,1,220,218
49192 DATA157,244,193,104,56,106,202,16,94
49200 DATA240,8B,162,63,169,255,157,252,154
49208 DATA193,202,16,250,162,0,160,0,15
49216 DATA189,244,193,134,251,162,7,10,230
49224 DATA72,144,5,169,0,153,252,193,36
49232 DATA200,104,202,16,242,166,251,232,213
49240 DATA192,64,208,228,96,162,24,169,207
49248 DATA0,157,0,212,202,16,250,169,78
49256 DATA160,141,2,212,141,9,212,141,98
49264 DATA16,212,169,15,141,3,212,141,253
49272 DATA10,212,141,17,212,169,0,141,254
49280 DATA5,212,141,12,212,141,19,212,58
49288 DATA169,249,141,6,212,141,13,212,255
49296 DATA141,20,212,169,15,141,24,212,54
49304 DATA169,255,141,52,3,141,53,3,201
49312 DATA141,54,3,169,64,141,55,3,22
49320 DATA96,174,52,3,48,24,189,252,238
49328 DATA193,240,8,169,0,157,252,193,108
49336 DATA76,198,192,173,55,3,141,4,2
49344 DATA212,169,255,141,52,3,174,53,227
49352 DATA3,48,24,189,252,193,240,8,133
49360 DATA169,0,157,252,193,76,227,192,194
49368 DATA173,55,3,141,11,212,169,255,211
49376 DATA141,53,3,174,54,3,48,24,212
49384 DATA189,252,193,240,8,169,0,157,160
49392 DATA252,193,76,0,193,173,55,3,161
49400 DATA141,18,212,169,255,141,54,3,217
49408 DATA96,162,0,134,251,173,52,3,103
49416 DATA48,11,173,53,3,48,6,173,11
49424 DATA54,3,48,1,96,189,130,193,218
49432 DATA168,185,252,193,240,3,32,39,112
49440 DATA193,232,224,23,208,223,96,173,124
49448 DATA52,3,16,3,76,80,193,173,124
49456 DATA53,3,16,3,76,105,193,152,137
49464 DATA141,54,3,189,153,193,141,14,176
49472 DATA212,189,176,193,141,15,212,173,95
49480 DATA55,3,9,1,141,1B,212,96,95
49488 DATA152,141,52,3,189,153,193,141,80
49496 DATA0,212,189,176,193,141,1,212,188
49504 DATA173,55,3,9,1,141,4,212,182
49512 DATA96,152,141,53,3,1B9,153,193,60
49520 DATA141,7,212,189,176,193,141,8,155
49528 DATA212,173,55,3,9,1,141,11,213
49536 DATA212,96,57,60,14,15,9,22,101
49544 DATA23,17,20,30,31,25,38,39,103
49552 DATA33,36,46,41,44,54,55,49,246
49560 DATA52,135,134,162,223,62,193,107,196
49568 DATA60,57,99,190,75,15,12,69,225
49576 DATA191,125,131,214,121,115,199,124,108
49584 DATA33,35,37,39,42,44,47,50,247
49592 DATA53,56,59,63,67,71,75,79,195
49600 DATAB4,89,94,100,106,112,119,173,45
49608 DATA255,193,240,6,169,16,141,55,251
49616 DATA3,96,173,254,193,240,6,169,62
49624 DATA32,141,55,3,96,173,253,193,138
49632 DATA240,6,169,64,141,55,3,96,230
49640 DATA173,0,194,240,6,104,104,169,198
49648 DATA0,133,198,96,0,0,0,0,155
```

Amstrad Disk ROM Disabling

by JR Wozniak

If you want to run some of your old CPC464 software on your new CPC6128, a few programs will not load because the disk ROM takes up an extra 1.25k. The following program releases this block of RAM and re-boots the system.

Another problem that may arise when trying to run CPC464 programs on the CPC6128 is that various software houses have written programs that access routines in firmware directly, instead of via the jump block tables as recommended by Amstrad. There is little that can be done about this without access to the source code.

```
30 MEMORY &9FFF: a=&A000
40 READ d$
50 WHILE d$<>"0"
60    POKE a, VAL("&"+d$): a=a+1:READ d$
70 WEND
80 CALL &A000
90 DATA 21,08,A0,0E,00,CD,16,BD,3E,C9,32,CB,BC,C3,05,C0,0
```

Zipsort

by K Riordan

MICROTEX 666

Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

"Some time ago (see Sought of sorts, June 1985 *APC*, page 171) I exposed the relative advantage in speed of a combined distribution count/"smart" bubble sort technique over the more familiar Quicksort in the ordering of string arrays. The initials of the string elements themselves formed the basis of the distribution count, which grouped together all elements with the same initial; the bubble sort completed the task by ordering each of the resultant sub-groups in turn.

However, since I had a specific task in mind — to read an unordered index from disk relative file, sort it and write it back to disk again — I was not particularly satisfied with the improved routine, which still required more than five minutes to sort a 500-element array of randomly-generated strings. It appeared

to me that machine code would speed the whole process up dramatically.

The job was easy. I was, after all, dealing with only one array whose elements were of equal length (this is a requirement of relative files) and which were simple to find in memory. I therefore settled on a bubble sort algorithm which reduced the sort time of the 500-element test array to a mere twelve seconds!

This improvement was quite spectacular, but I was not fooled. The routine was job-specific and had virtually no other application; in particular, it had no provision for handling numeric data. However, I was sufficiently encouraged to turn my attention to writing a general-purpose machine code sort.

In devising its specifications, it was evident to me that the sort would have to meet the following requirements:

- it must be fast enough to be useful;
- its syntax must be simple;
- it must handle multiple arrays of any type;
- it must be capable of sorting in ascending or descending order;
- it must allow the user the option of including the zero elements of arrays in the sort; and
- it must not make extraordinary demands on memory.

On the basis of these considerations, I rejected the distribution count method as a contender for the sort algorithm. Despite its speed, it does not lend itself to general-purpose application where numeric data are concerned. One must know in advance the range and frequency of numeric data likely to be encountered by the algorithm.

Similarly, I rejected the Quicksort algorithm because it requires dynamic space in which to 'remember' its partition pointers. This requirement can often present difficulty even when running in Basic; it is downright disconcerting when a BAD SUBSCRIPT message trumpets the fact that one has not defined a sufficiently large partition pointer array for the job in hand. The problems of writing a machine code Quicksort for unknown users therefore appeared insurmountable.

Only the Shellsort and the bubble sort remained in consideration — and it was no contest. To order the original 500-element test array, the bubble sort would perform 125,000 comparisons and a massive 63,000 exchanges. By contrast, the Shellsort would perform only 26,000 comparisons and 3,200 exchanges. There was no doubt that the Shellsort would be very much faster.

At this point it will be instructive to examine the way in which Basic handles arrays. A clear understanding of this process will render the Shellsort assembly listing comprehensible even to novice programmers.

The zero page ARYTAB variable, located at $2F,$30 in the Commodore 64, points to the first byte designated by Basic as array space. Each array defined by a Basic program has a descriptor built in this space at the time that its DIM statement is executed. The descriptor is seven bytes long and is followed by the elements of the array it describes.

For the various types of array, descriptors take the following forms:

Array Type	Byte	Purpose
String	0-1	Array name in positive-negative ASCII format
	2-3	Byte offset to next array in normal lo-hi format
	4	Number of dimensions
	5-6	Number of elements in hi-lo format; followed by 3 bytes per element:
	0	Length of string element
	1-2	Element pointer in lo-hi format
Integer	0-1	Array name in negative-negative ASCII format
	2-3	Byte offset to next array in lo-hi format
	4	Number of dimensions
	5-6	Number of elements in hi-lo format; followed by 2 bytes per element containing integer elements in hi-lo format
Real	0-1	Array name in positive-positive ASCII format
	2-3	Byte offset to next array in lo-hi format
	4	Number of dimensions
	5-6	Number of elements in hi-lo format; followed by 5 bytes per element:
	0	Exponent
	1	Mantissa (high order)
	2	Mantissa (middle order (high))
	3	Mantissa (middle order (low))
	4	Mantissa (low order)

When a Basic program refers to an array, the operating system firstly verifies that it is indeed looking for an array (by checking for the opening subscript bracket) and skips directly to array space by applying the zero page ARYTAB pointer. If it does not find the required array name at the first two bytes, it applies the offset found in the next two bytes to examine the next array, continuing this process until the required array is found or array space is completely traversed. If the latter condition prevails, Basic defines a default one-dimensional array of the given name and type with the minimum number of elements, each of which is null or zero.

There are two on-board array routines which can be tapped by the machine code programmer. These are FNDVAR and FDLMNT.

FNDVAR finds the array whose name is in VARNAM, returning the address of its zero element in VARPTR.

FDLMNT finds a designated element of an array. The array name must be in VARNAM, its zero element address must be in HIGHDS and the required element number must be in FBUFPT. It returns the address of the required element in VARPTR and in the A and Y registers.

Looking now at our Shellsort routine, we can say that the algorithm works by applying half the size of the key array as a gap, successively comparing elements separated by the gap and exchanging them as necessary. It repeats this process, halving the gap with each repetition until the gap is equal to or less than unity, at which time the array is sorted.

Standard Basic coding for the Shellsort of an array with TOTAL elements takes the form:

```
100 GAP=TOTAL:START=(0 or 1 as
    required)
110 IF GAP<=1 THEN (sort
    completed)
120 GAP=INT(GAP/2):LIMIT=
    TOTAL-GAP
130 SWAPFLAG=0:FOR LOWER
    =START TO LIMIT:UPPER
    =LOWER+GAP
140 IF ARRAY(LOWER)<=ARRAY
    (UPPER):THEN 160
150 SWAP ARRAY(LOWER),ARRAY
    (UPPER):SWAPFLAG=1
160 NEXT:IF SWAPFLAG>0 THEN
    130 ELSE 110
```

I have used this coding as commentary throughout the assembly listing to make it easy to follow. It is located at $C000 (49152), so that it needs no protection from rampaging strings defined by your Basic program.

The syntax of the command to activate the routine is simple: SYS49152,D$,E, ARRAY LIST where D$ = either A or D to designate an ascending or descending sort, and E = either 0 or 1 to specify from which element the sort is to commence.

The array list is simply a list of array names in the form A$(0),A%(0),A(0). Each item in the command must be separated from its neighbour by a comma and the zero subscript must be used for each array in the sort list. Failure

to observe the latter rule will result in FNDVAR pointing to a faulty location and memory will become completely scrambled as a consequence.

All arrays in the list must be one-dimensional and contain the same number of elements. The routine tests both conditions and exits to its own error message if either is not met. Any other error in the command line causes a SYNTAX ERROR.

The first-named array in the list is the key array and all others are sorted in correspondence with it. If, for example, A$ is the key array and A$(5) and A$(200) are exchanged during the sort process, elements 5 and 200 of all other arrays in the list will be exchanged at the same time.

Note, however, that the routine is just as effective if only the key array is named in the list.

For the benefit of users who do not have access to an assembler, Listing 2 provides a Basic loader which automatically saves the routine to disk under the filename ZIPSORT.

I regret that I am only able to provide a Commodore 64 listing. This deficiency limits my claim that the routine is truly general purpose. However, the algorithm holds good for any operating system and the program should not be difficult to transcribe to any other 6502 (or, for that matter, any Z80) machine. You only need to discover the equivalent zero page pointers and ROM calls in your machine to get it up and running.

Typical timings for various array sizes, using one randomly-generated array of each type in the list, appear below, showing in brackets comparative times achieved by the standard Basic Shellsort earlier described:

Array Size	Where the key array was String	Integer	Real
50	2 (22)	2 (21)	2 (16)
100	7 (57)	5 (54)	5 (59)
200	18 (138)	17 (141)	19 (155)
300	29 (226)	25 (223)	33 (251)
400	53 (413)	47 (365)	56 (408)
500	58 (517)	51 (451)	69 (535)

*All times are shown in seconds

As you see, the figures indicate an average 87% reduction in sort time when ZIPSORT is on the job!

I do not pretend that the routine is as elegantly coded as it might be. Compression is possible by reducing several sections of common code to subroutines. I chose the top-down coding presentation to make the routine more easily comprehensible to budding machine code programmers, whose struggles to learn are very often disregarded by those of us who are fortunate enough to have some idea of what we are doing!

Here, then, are the listings:

Listing 1

```
LINE# LOC   CODE       LINE

00001  0000            ARRAYS = $02
00002  0000            SWPFLG = $02
00003  0000            LINNUM = $14
00004  0000            INDEX  = $22
00005  0000            VARNAM = $45
00006  0000            VARPTR = $47
00007  0000            TEMP1  = $4E
00008  0000            TEMP2  = $51
00009  0000            HIGHDS = $58
00010  0000            FBUFPT = $71
00011  0000            EXPTR  = $F8
00012  0000            PTR    = $FD
00013  0000            CHRGET = $0073
00014  0000            CHRGOT = $0079
00015  0000            READY  = $A474
00016  0000            CHKCOM = $AEFD
00017  0000            SYNERR = $AF08
00018  0000            FNDVAR = $0B9B
00019  0000            FQLMNT = $B32A
00020  0000            MOVFM  = $BBA2
00021  0000            FCOMP  = $BC5B
00022  0000            CHROUT = $FFD2

00025  0000            *      = $C000

00028  C000            ;PARSE COMMAND LINE

00031  C000  A9 00     SORT   LDA #$00        ;ZERO ARRAY COUNT.
00032  C002  85 02            STA ARRAYS
00033  C004  20 FD AE         JSR CHKCOM
00034  C007  C9 41            CMP #$41        ;ENSURE 'A/D PARAMETER PRESENT.
00035  C009  F0 07            BEQ SORT2
00036  C00B  C9 44            CMP #$44
00037  C00D  F0 06            BEQ SORT3
00038  C00F  4C 08 AF   ERRDR  JMP SYNERR
00039  C012  A9 00      SORT2  LDA #$00        ;SET FLAG BIT 7 IF DESCENDING
00040  C014  2C                .BYT #2C        ;  SORT IS REQUIRED.
00041  C015  A9 80      SORT3  LDA #$80
00042  C017  8D B6 C2         STA FLAG
00043  C01A  20 73 00         JSR CHRGET
00044  C01D  20 FD AE         JSR CHKCOM      ;CHECK FOR COMMA AFTER A/D.
00045  C020  C9 30            CMP #$30        ;ENSURE 0/1 PARAMETER PRESENT.
00046  C022  F0 0C            BEQ SORT4
00047  C024  C9 31            CMP #$31
00048  C026  D0 E7            BNE ERRDR
00049  C028  A9 40            LDA #$40        ;SET FLAG BIT 6 IF SORT
00050  C02A  0D B6 C2         ORA FLAG        ;  IS TO COMMENCE FROM
00051  C02D  8D B6 C2         STA FLAG        ;  ELEMENT 1.
00052  C030  A0 B7      SORT4  LDA #(ARYLST    ;POINT TO OUR ARRAY LIST.
00053  C032  85 FD            STA PTR
00054  C034  A9 C2            LDA #>ARYLST
00055  C036  85 FE            STA PTR+1
00056  C038  20 73 00         JSR CHRGET
00057  C03B  20 79 00   SORT5  JSR CHRGOT      ;CHECK FOR END OF ARRAY LIST
00058  C03E  F0 60            BEQ SORT11      ;  AND COMMA AFTER EACH ITEM.
00059  C040  C9 2C            CMP #$2C
00060  C042  D0 C8            BNE ERRDR
00061  C044  20 73 00         JSR CHRGET      ;POINT TO NEXT ARRAY NAME.
00062  C047  20 00 00         JSR FNDVAR      ;FIND ITS ZERO ELEMENT.
00063  C04A  38                SEC             ;POINT BACK TO ITS DESCRIPTOR.
00064  C04B  A5 47            LDA VARPTR
00065  C04D  E9 07            SBC #$07
00066  C04F  85 71            STA FBUFPT
00067  C051  A5 48            LDA VARPTR+1
00068  C053  E9 00            SBC #$00
00069  C055  85 72            STA FBUFPT+1
00070  C057  A0 04            LDY #$04        ;ENSURE ARRAY HAS ONLY ONE
00071  C059  B1 71            LDA (FBUFPT),Y  ;  DIMENSION.
00072  C05B  C9 01            CMP #$01
00073  C05D  F0 0B            BEQ SORT7
00074  C05F  A2 00            LDX #$00
00075  C061  2C                .BYT #2C
00076  C062  A2 16      SORT6  LDX #$16
00077  C064  4C 73 C2         JMP ERRXIT
00078  C067  C8         SORT7  INY             ;IF THIS IS THE KEY ARRAY,
00079  C068  B1 71            LDA (FBUFPT),Y  ;  MEMORISE ITS SIZE, ELSE
00080  C06A  A6 02            LDX ARRAYS      ;  ENSURE THIS ARRAY'S SIZE
00081  C06C  F0 05            BEQ SORT8       ;  MATCHES THAT OF THE KEY
00082  C06E  CD 85 C2         CMP TOTAL+1     ;  ARRAY.
00083  C071  D0 EF            BNE SORT6
00084  C073  8D 85 C2   SORT8  STA TOTAL+1
00085  C076  C8                INY
00086  C077  B1 71            LDA (FBUFPT),Y
00087  C079  A6 02            LDX ARRAYS
00088  C07B  F0 05            BEQ SORT9
00089  C07D  CD 84 C2         CMP TOTAL
00090  C080  D0 E0            BNE SORT6
00091  C082  8D 84 C2   SORT9  STA TOTAL
00092  C085  A0 03            LDY #$03        ;COPY ARRAY NAME AND ZERO
00093  C087  B9 45 00   SORT10 LDA VARNAM,Y    ;  ELEMENT ADDRESS TO OUR
00094  C08A  91 FD            STA (PTR),Y     ;  ARRAY LIST.
00095  C08C  88                DEY
00096  C08D  10 F8            BPL SORT10
00097  C08F  18                CLC             ;ADVANCE ARRAY LIST POINTER,
00098  C090  A5 FD            LDA PTR         ;  BUMP ARRAY COUNT AND
00099  C092  69 04            ADC #$04        ;  REPEAT PROCESS FOR NEXT
00100  C094  85 FD            STA PTR         ;  ARRAY IN THE COMMAND LINE.
00101  C096  A5 FE            LDA PTR+1
00102  C098  69 00            ADC #$00
00103  C09A  85 FE            STA PTR+1
00104  C09C  E6 02            INC ARRAYS
00105  C09E  D0 98            BNE SORT5

00108  C0A0                  ;COMMENCE SORT

00111  C0A0  AD B4 C2   SORT11 LDA TOTAL       ;SINCE BASIC 'REMEMBERS'
00112  C0A3  D0 03            BNE SORT12      ;  ARRAY SIZE AS SIZE+1,
00113  C0A5  CE 85 C2         DEC TOTAL+1     ;  WE MUST BEGIN BY
00114  C0A8  CE 84 C2   SORT12 DEC TOTAL      ;  DOWNDATING TOTAL.
00115  C0AB  AD B4 C2         LDA TOTAL       ;GAP=TOTAL.
00116  C0AE  8D B2 C2         STA GAP
00117  C0B1  AD B5 C2         LDA TOTAL+1
00118  C0B4  8D B3 C2         STA GAP+1
00119  C0B7  AD B2 C2   SORT13 LDA GAP         ;IF GAP(=1 THEN (SORT
00120  C0BA  C9 02            CMP #$02        ;  COMPLETED).
00121  C0BC  AD B3 C2         LDA GAP+1
00122  C0BF  E9 00            SBC #$00
00123  C0C1  B0 01            BCS SORT14
00124  C0C3  60                RTS
00125  C0C4  4E 03 C2   SORT14 LSR GAP+1       ;GAP=INT(GAP/2).
00126  C0C7  6E B2 C2         ROR GAP
00127  C0CA  38                SEC             ;LIMIT=TOTAL-GAP.
00128  C0CB  AD B4 C2         LDA TOTAL
00129  C0CE  ED B2 C2         SBC GAP
00130  C0D1  8D AC C2         STA LIMIT
00131  C0D4  AD B5 C2         LDA TOTAL+1
00132  C0D7  ED B3 C2         SBC GAP+1
00133  C0DA  8D AD C2         STA LIMIT+1
00134  C0DD  A9 00      SORT15 LDA #$00        ;SWAPFLAG=0
00135  C0DF  85 02            STA SWPFLG
00136  C0E1  A2 FF            LDX #$FF        ;START=(0 OR 1 AS REQUIRED)
00137  C0E3  2C B6 C2         BIT FLAG        ;  (NOTE THAT WE INITIALISE
00138  C0E6  50 01            BVC SORT16      ;  START TO -1 OR 0 HERE).
00139  C0E8  E8                INX
00140  C0E9  8E 00 C2   SORT16 STX LOWER
00141  C0EC  8E B1 C2         STX LOWER+1
00142  C0EF  EE 00 C2   SORT17 INC LOWER       ;FOR LOWER=START TO LIMIT.
00143  C0F2  D0 03            BNE SORT18
00144  C0F4  EE B1 C2         INC LOWER+1
00145  C0F7  A0 AC C2   SORT18 LDA LIMIT       ;NEXT (IT'S MORE CONVENIENT
00146  C0FA  CD B8 C2         CMP LOWER       ;  TO DO OUR END-OF-LOOP CHECK
00147  C0FD  A0 AD C2         LDA LIMIT+1     ;  AT THE BEGINNING OF EACH
00148  C100  ED B1 C2         SBC LOWER+1     ;  REPETITION).
00149  C103  B0 06            BCS SORT19
00150  C105  A5 02            LDA SWPFLG
00151  C107  D0 D4            BNE SORT15      ;IF SWAPFLAG=1 THEN 130
00152  C109  F0 AC            BEQ SORT13      ;  ELSE 110.
00153  C10B  A2 03      SORT19 LDX #$03        ;COPY KEY ARRAY DETAILS
00154  C10D  BD B7 C2   SORT20 LDA ARYLST,X    ;  INTO VARNAM, VARPTR.
00155  C110  95 45            STA VARNAM,X
00156  C112  CA                DEX
00157  C113  10 F8            BPL SORT20
00158  C115  A5 47            LDA VARPTR      ;POINT HIGHDS AT ZERO ELEMENT
00159  C117  85 58            STA HIGHDS      ;  OF KEY ARRAY.

00160  C119  A5 4B            LDA VARPTR+1
00161  C11B  85 59            STA HIGHDS+1
00162  C11D  AD B0 C2         LDA LOWER       ;STORE # OF LOWER ELEMENT
00163  C120  85 71            STA FBUFPT      ;  IN FBUFPT.
00164  C122  AD B1 C2         LDA LOWER+1
00165  C125  85 72            STA FBUFPT+1
```

```
00166  C127  20 2A B3          JSR FOLMNT      ;FIND LOWER ELEMENT AND POINT
00167  C12A  85 FB             STA EXPTR       ;  EXPTR AT IT.
00168  C12C  84 FC             STY EXPTR+1
00169  C12E  18                CLC             ;UPPER=LOWER+GAP.
00170  C12F  AD B0 C2          LDA LOWER
00171  C132  6D 02 C2          ADC GAP
00172  C135  8D AE C2          STA UPPER
00173  C138  AD B1 C2          LDA LOWER+1
00174  C13B  6D B3 C2          ADC GAP+1
00175  C13E  8D AF C2          STA UPPER+1
00176  C141  A2 03             LDX #$03        ;SINCE VARPTR HAS BEEN
00177  C143  BD B7 C2  SORT21  LDA ARYLST,X    ;  CLOBBERED, COPY KEY
00178  C146  95 45             STA VARNAM,X    ;  ARRAY DETAILS TO ZERO
00179  C148  CA                DEX             ;  PAGE AGAIN.
00180  C149  10 F8             BPL SORT21
00181  C14B  A5 47             LDA VARPTR      ;POINT HIGHDS AT ZERO
00182  C14D  85 5B             STA HIGHDS      ;  ELEMENT.
00183  C14F  A5 4B             LDA VARPTR+1
00184  C151  85 59             STA HIGHDS+1
00185  C153  AD AE C2          LDA UPPER       ;STORE # OF UPPER ELEMENT
00186  C156  85 71             STA FBUFPT      ;  IN FBUFPT.
00187  C158  AD AF C2          LDA UPPER+1
00188  C15B  85 72             STA FBUFPT+1
00189  C15D  20 2A B3          JSR FOLMNT      ;POINT VARPTR AT UPPER ELEMENT.
00190  C160  2C B6 C2          BIT FLAG        ;NOW, WHAT SORT DIRECTION
00191  C163  30 51             BMI SORT26      ;  DO WE WANT?

00193  C165                    ;HANDLE ASCENDING SORT.

00194  C165  24 45             BIT VARNAM      ;WHAT KIND OF ARRAY IS THE
00195  C167  3B 1C             BMI SORT22      ;  KEY ARRAY (REMEMBER THAT
00196  C169  24 46             BIT VARNAM+1    ;  ARRAY NAMES ARE REPRESENTED
00197  C16B  3B 27             BMI SORT23      ;  BY DIFFERING FORMATS)?
00198  C16D  A5 FB             LDA EXPTR       ;IF FLOATING POINT, MOVE
00199  C16F  A4 FC             LDY EXPTR+1     ;  LOWER ELEMENT TO FLOATING
00200  C171  20 A2 BB          JSR MOVFM       ;  POINT ACCUMULATOR.
00201  C174  A5 47             LDA VARPTR      ;POINT TO UPPER ELEMENT AND
00202  C176  A4 4B             LDY VARPTR+1    ;  COMPARE THE TWO (NO
00203  C178  20 5B BC          JSR FCOMP       ;  EXCHANGE IS NECESSARY IF
00204  C17B  F0 02             BEQ NOSWAP      ;  Z OR N FLAG SET, I.E
00205  C17D  10 03             BPL GOSWAP      ;  LOWER(=UPPER).
00206  C17F  4C EF C0  NOSWAP  JMP SORT17
00207  C182  4C 04 C2  GOSWAP  JMP SWAP
00208  C185  A0 01     SORT22  LDY #$01        ;IF INTEGER, COMPARE THE
00209  C187  B1 47             LDA (VARPTR),Y  ;  TWO DIRECTLY (REMEMBER
00210  C189  D1 FB             CMP (EXPTR),Y   ;  THAT INTEGER ELEMENTS ARE
00211  C18B  88                DEY             ;  STORED IN HI-LO FORMAT).
00212  C18C  B1 47             LDA (VARPTR),Y
00213  C18E  F1 FB             SBC (EXPTR),Y
00214  C190  B0 ED             BCS NOSWAP
00215  C192  90 EE             BCC GOSWAP
00216  C194  A0 02     SORT23  LDY #$02        ;IF STRING, COPY BOTH LOWER
00217  C196  B1 FB     SORT24  LDA (EXPTR),Y   ;  AND UPPER ELEMENTS
00218  C198  99 4E 00          STA TEMP1,Y     ;  INTO TEMPORARY ZERO PAGE
00219  C19B  B1 47             LDA (VARPTR),Y  ;  STORAGE WHERE WE CAN


00221  C19D  99 51 00          STA TEMP2,Y     ;  MORE EASILY WORK ON THEM.
00222  C1A0  88                DEY
00223  C1A1  10 F3             BPL SORT24
00224  C1A3  C8        SORT25  INY             ;COMPARE NEXT LEFTMOST
00225  C1A4  C4 4E             CPY TEMP1       ;  CHARACTERS OF EACH STRING
00226  C1A6  B0 D7             BCS NOSWAP      ;  IN TURN; KEEP SCANNING
00227  C1A8  C4 51             CPY TEMP2       ;  IF LOWER CHARACTER <
00228  C1AA  90 D3             BCC NOSWAP      ;  UPPER OR IF EITHER STRING
00229  C1AC  B1 4F             LDA (TEMP1+1),Y ;  LENGTH REACHED; AND
00230  C1AE  D1 52             CMP (TEMP2+1),Y ;  EXCHANGE ONLY IF LOWER
00231  C1B0  B0 CD             BCC NOSWAP      ;  CHARACTER ) UPPER.
00232  C1B2  F0 EF             BEQ SORT25
00233  C1B4  B0 CC             BCS GOSWAP

00235  C1B6                    ;HANDLE DESCENDING SORT.

00237  C1B6  24 45     SORT26  BIT VARNAM      ;THIS SECTION OF CODE
00238  C1B8  30 1B             BMI SORT27      ;  SIMPLY REVERSES THE DIRECTION
00239  C1BA  24 46             BIT VARNAM+1    ;  SET BY THE FOREGOING
00240  C1BC  30 23             BMI SORT28      ;  SECTION.
00241  C1BE  A5 47             LDA VARPTR
00242  C1C0  A4 4B             LDY VARPTR+1
00243  C1C2  20 A2 BB          JSR MOVFM
00244  C1C5  A5 FB             LDA EXPTR
00245  C1C7  A4 FC             LDY EXPTR+1
00246  C1C8  20 5B BC          JSR FCOMP
00247  C1CC  F0 B1             BEQ NOSWAP
00248  C1CE  30 AF             BMI NOSWAP
00249  C1D0  10 32             BPL SWAP
00250  C1D2  A0 01     SORT27  LDY #$01
00251  C1D4  B1 FB             LDA (EXPTR),Y
00252  C1D6  D1 47             CMP (VARPTR),Y
00253  C1D8  88                DEY
00254  C1D9  B1 FB             LDA (EXPTR),Y
00255  C1DB  F1 47             SBC (VARPTR),Y
00256  C1DD  90 A0             BCC NOSWAP
00257  C1DF  90 23             BCC SWAP
00258  C1E1  A0 02     SORT28  LDY #$02
00259  C1E3  B1 FB     SORT29  LDA (EXPTR),Y
00260  C1E5  99 4E 00          STA TEMP1,Y
00261  C1E8  B1 47             LDA (VARPTR),Y
00262  C1EA  99 51 00          STA TEMP2,Y
00263  C1ED  88                DEY
00264  C1EE  10 F3             BPL SORT29
00265  C1F0  C8        SORT30  INY
00266  C1F1  C4 4E             CPY TEMP1
00267  C1F3  B0 0C             BCS SORT31
00268  C1F5  C4 51             CPY TEMP2
00269  C1F7  B0 08             BCS SORT31
00270  C1F9  B1 52             LDA (TEMP2+1),Y
00271  C1FB  D1 4F             CMP (TEMP1+1),Y
00272  C1FD  F0 F1             BEQ SORT30
00273  C1FF  B0 03             BCS SWAP
00274  C201  4C EF C0  SORT31  JMP SORT17




00276  C204                    ;EXCHANGE ELEMENTS.

00278  C204  A8 01     SWAP    LDA #$01        ;SWAPFLAG=1.
00279  C206  85 02             STA SWPFLG
00280  C208  A8 B7             LDA #(ARYLST    ;POINT TO THE START OF
00281  C20A  85 14             STA LINNUM      ;  OUR ARRAY LIST.
00282  C20C  A0 C2             LDA #>ARYLST
00283  C20E  85 15             STA LINNUM+1
00284  C210  A0 03     SWAP2   LDY #$03        ;COPY DETAILS OF INDICATED
00285  C212  B1 14     SWAP3   LDA (LINNUM),Y  ;  ARRAY TO VARNAM, VARPTR
00286  C214  99 45 00          STA VARNAM,Y    ;  AND TO TEMP1.
00287  C217  88                DEY
00288  C218  10 F8             BPL SWAP3
00289  C21A  A5 47             LDA VARPTR      ;POINT HIGHDS AT ZERO ELEMENT.
00290  C21C  85 5B             STA HIGHDS
00291  C21E  A5 4B             LDA VARPTR+1
00292  C220  85 5B             STA HIGHDS+1
00293  C222  A0 B0 C2          LDA LOWER       ;STORE # OF LOWER ELEMENT
00294  C225  85 71             STA FBUFPT      ;  IN FBUFPT.
00295  C227  A0 B1 C2          LDA LOWER+1
00296  C22A  85 72             STA FBUFPT+1
00297  C22C  20 2A B3          JSR FOLMNT      ;FIND LOWER ELEMENT AND
00298  C22F  85 22             STA INDEX       ;  POINT INDEX AT IT.
00299  C231  84 23             STY INDEX+1
00300  C233  AD AE C2          LDA UPPER       ;STORE # OF UPPER ELEMENT
00301  C236  85 71             STA FBUFPT      ;  IN FBUFPT.
00302  C238  AD AF C2          LDA UPPER+1
00303  C23B  85 72             STA FBUFPT+1
00304  C23D  20 2A B3          JSR FOLMNT      ;POINT VARPTR AT UPPER ELEMENT.
00305  C240  24 45             BIT VARNAM      ;WHAT KIND OF ARRAY ARE
00306  C242  30 07             BMI SWAP4       ;  WE DEALING WITH?
00307  C244  24 46             BIT VARNAM+1
00308  C246  30 06             BMI SWAP5
00309  C248  A0 04             LDY #$04        ;SET ELEMENT LENGTH ACCORDINGLY.
00310  C24A  2C                .BYT $2C
00311  C24B  A0 01     SWAP4   LDY #$01
00312  C24D  2C                .BYT $2C
00313  C24E  A0 02     SWAP5   LDY #$02
00314  C250  B1 22     SWAP6   LDA (INDEX),Y   ;EXCHANGE THE TWO
00315  C252  AA                TAX             ;  INDICATED ELEMENTS.
00316  C253  B1 47             LDA (VARPTR),Y
00317  C255  91 22             STA (INDEX),Y
00318  C257  8A                TXA
00319  C258  91 47             STA (VARPTR),Y
00320  C25A  88                DEY
00321  C25B  10 F3             BPL SWAP6
00322  C25D  18                CLC             ;POINT TO THE NEXT ARRAY
00323  C25E  A5 14             LDA LINNUM      ;  IN OUR LIST AND RESUME
00324  C260  69 04             ADC #$04        ;  THE SORT WHEN INDICATED
00325  C262  90 02             BCC SWAP7       ;  ELEMENTS OF ALL ARRAYS
00326  C264  E6 15             INC LINNUM+1    ;  HAVE BEEN EXCHANGED.
00327  C266  85 14     SWAP7   STA LINNUM
00328  C268  C5 FD             CMP PTR
00329  C26A  A5 15             LDA LINNUM+1
00330  C26C  E5 FE             SBC PTR+1


00331  C26E  90 A0             BCC SWAP2
00332  C270  4C EF C0          JMP SORT17
00333  C273  BD 01 C2  ERRXIT  LDA TEXT,X
00334  C276  F0 06             BEQ ERX2
00335  C278  20 D2 FF          JSR CHROUT
00336  C27B  E8                INX
00337  C27C  D0 F5             BNE ERRXIT
00338  C27E  4C 74 A4  ERX2    JMP READY
00339  C281  00        TEXT    .BYT $00,$54
00338  C282  54
00340  C283  4F                .BYT $4F,$4F
00340  C284  4F
00341  C285  20                .BYT $20,$4D
00341  C286  4D
00342  C287  41                .BYT $41,$4E
00342  C288  4E
00343  C289  59                .BYT $59,$20
00343  C28A  20
00344  C28B  44                .BYT $44,$49
00344  C28C  49
00345  C28D  4D                .BYT $4D,$45
00345  C28E  45
00346  C28F  4E                .BYT $4E,$53
00346  C290  53
00347  C291  49                .BYT $49,$4F
00347  C292  4F
00348  C293  4E                .BYT $4E,$53
00348  C294  53
00348  C295  00                .BYT $00,$00
00348  C296  00
00356  C297  00                .BYT $00,$41
00350  C298  41
00351  C299  52                .BYT $52,$52
00351  C29A  52
00352  C29B  41                .BYT $41,$59
00352  C29C  59
00353  C29D  20                .BYT $20,$53
00353  C29E  53
00354  C29F  49                .BYT $49,$5A
00354  C2A0  5A
00355  C2A1  45                .BYT $45,$53
00355  C2A2  53
00356  C2A3  20                .BYT $20,$44
00356  C2A4  44
00357  C2A5  4B                .BYT $49,$46
00357  C2A6  46
00358  C2A7  46                .BYT $46,$45
00358  C2A8  45
00359  C2A9  52                .BYT $52,$00
00358  C2AA  00
00360  C2AB  00                .BYT $00
00361  C2AC  00 00     LIMIT   .WOR $0000
00362  C2AE  00 00     UPPER   .WOR $0000
00363  C2B0  00 00     LOWER   .WOR $0000
00364  C2B2  00 00     GAP     .WOR $0000


00365  C2B4  00 00     TOTAL   .WOR $0000
00366  C2B6  00        FLAG    .BYT $00
00367  C2B7  00        ARYLST  .BYT $00
00368  C2B8                    .END


ERRORS = 00000


SYMBOL TABLE

SYMBOL VALUE
 ARRAYS   0002    ARYLST   C2B7    CHKCOM   AEFD    CHRGET   0073
 CHROUT   0078    CHROUT   FFD2    ERRDR    C00F    ERRXIT   C273
 ERX2     C27E    EXPTR    00FB    FBUFPT   0071    FCOMP    BC5B
 FOLMNT   B32A    FLAG     C2B6    FNDVAR   B08B    GAP      C2B2
 GOSWAP   C1B2    HIGHDS   005B    INDEX    0022    LIMIT    C2AC
 LINNUM   0014    LOWER    C2B0    MOVFM    BBA2    NOSWAP   C17F
 PTR      00FD    READY    A474    SORT     C000    SORT1B   C0B7
 SORT11   C0A8    SORT12   C0AB    SORT13   C0B7    SORT14   C0C4
 SORT15   C0D0    SORT16   C0E9    SORT17   C0EF    SORT1B   C0F7
 SORT19   C100    SORT2    C012    SORT28   C10D    SORT21   C143
 SORT22   C195    SORT23   C194    SORT24   C196    SORT25   C1A3
 SORT26   C1B6    SORT27   C1D2    SORT28   C1E1    SORT29   C1E3
 SORT3    C015    SORT30   C1F8    SORT31   C201    SORT4    C030
 SORT5    C03B    SORT6    C062    SORT7    C067    SORT8    C073
 SORT9    C00Z    SWAP     C204    SWAP2    C210    SWAP3    C212
 SWAP4    C248    SWAP5    C24E    SWAP6    C250    SWAP7    C266
 SWPFLG   0002    SYNERR   AF00    TEMP1    004E    TEMP2    0051
 TEXT     C2B1    TOTAL    C2B4    UPPER    C2AE    VARNAM   0045
 VARPTR   0047

END OF ASSEMBLY
```

Listing 2

```
100 F$="ZIPSORT":REM ENTER THIS LINE WITH NO INTERVENING SPACES!!!
110 FORX=48152TO49847:D=0:READH$
120 FORY=1TO2:A=ASC(MID$(H$,Y,1))-48
130 D=D*16+A+7*(A)9):NEXT
140 POKEX,D:NEXT
150 POKE790,1:POKE791,8:POKE782,91SYS65466
160 POKE790,7:POKE791,9:POKE782,91SYS65469
170 POKE253,8:POKE254,182:POKE780,253
180 POKE791,184:POKE782,184:SYS65466:END
60000 DATAA8,80,05,82,20,FD,AE,C8,41,F8,87,C8,44,F8,86,4C
60001 DATA88,AF,A9,00,2C,A8,80,8D,86,C2,20,73,80,20,FD,AE
60002 DATAC9,30,F0,0C,C9,31,D0,E7,A8,40,80,86,C2,9D,86,C2
60003 DATAA9,87,85,FD,A9,C2,85,FE,20,73,00,20,78,00,F0,60
60004 DATAC9,2C,D0,CB,20,73,00,20,6B,B0,36,A5,47,E9,07,85
60005 DATA71,A5,48,E9,00,85,72,90,04,81,71,C9,01,F0,06,A2
60006 DATA00,2C,A2,16,4C,73,C2,C9,01,71,A6,02,F0,05,CO,B5
60007 DATAC2,D0,EF,80,85,C2,C9,01,71,A6,02,F0,05,CO,B4,C2
60008 DATA08,E0,80,04,C2,A0,03,89,45,00,01,FD,BB,10,F8,18
60009 DATAA5,FD,69,04,05,FD,A5,FE,69,00,85,FE,E6,02,D0,99
60010 DATAAD,84,C2,D0,03,CE,85,CE,CE,84,C2,AD,84,C2,80,92
60011 DATAC2,A0,95,C2,80,03,C2,A0,02,C2,C9,02,A0,B3,C2,EB
60012 DATA00,00,01,00,4E,83,C2,6E,82,C2,3B,AD,84,C2,ED,02
60013 DATAC2,8D,AC,C2,A0,85,C2,E0,83,C2,8D,AD,C2,A9,00,05
60014 DATA02,A2,FF,2C,86,C2,58,01,E8,8E,88,C2,8E,81,C2,EE
60015 DATA80,C2,D0,03,EE,81,C2,AD,AC,C2,CD,00,C2,AD,AD,C2
60016 DRTAED,81,C2,00,86,A5,82,D8,D4,F8,AC,A2,83,80,B7,C2
60017 DRTA95,45,CA,10,F8,A5,47,85,5B,A5,48,85,59,AD,80,C2
60018 DATA85,71,AD,81,C2,85,72,20,2A,83,85,F8,84,FC,16,AD
60019 DATA80,C2,6D,B2,C2,8D,AE,C2,AD,B1,C2,6D,83,C2,8D,AF
60020 DATAC2,A2,03,BD,B7,C2,95,45,CA,10,F9,A5,47,85,5B,A5
60021 DATA48,85,59,AD,AE,C2,85,71,AD,AF,C2,85,72,20,2A,03
60022 DATA2C,B6,C2,30,51,24,45,30,1C,24,46,30,27,A5,FB,A4
60023 DATAFC,20,A2,BB,A5,47,A4,48,20,5B,BC,F0,02,10,03,4C
60024 DATAEF,C0,4C,84,C2,A0,01,B1,47,D1,F0,80,B1,47,F1,F0
60025 DATA00,ED,B0,EE,A0,02,91,F9,99,4E,00,01,47,00,51,00
60026 DATA88,10,F3,C9,C4,4E,00,D7,C4,51,00,03,B1,4F,01,52
60027 DATA88,CD,F0,EF,B0,CC,24,45,30,1B,24,46,30,23,A5,47
60028 DATAA4,49,20,A2,00,A5,FB,A4,FC,20,58,BC,F0,01,30,AF
60029 DATA1B,32,A0,01,91,F9,D1,47,00,B1,FB,F1,47,00,A0,00
60030 DATA23,A8,02,01,F0,99,4E,00,B1,47,99,51,00,00,10,F3
60031 DATACB,C4,4E,00,0C,C4,51,00,00,B1,52,01,4F,F0,F1,80
60032 DATA03,4C,EF,C0,A9,01,85,02,A9,B7,85,14,A9,C2,85,15
60033 DATAA0,03,91,14,99,45,00,BB,10,F0,A5,47,85,50,A5,49
60034 DATA85,59,AD,B0,C2,85,71,AD,91,C2,85,72,20,2A,03,95
60035 DATA22,04,23,AD,AE,C2,95,71,AD,AF,C2,95,72,20,2A,03
60036 DATA24,45,30,07,24,46,30,06,A0,04,2C,A0,01,2C,A0,02
60037 DATAB1,22,AA,B1,47,81,22,9A,81,47,88,10,F3,19,A5,14
60038 DATA69,04,80,02,E6,15,85,14,C5,FO,A5,15,E5,FE,90,A0
60039 DATA4C,EF,C0,BD,91,C2,F0,80,20,D2,FF,E8,D8,F5,4C,74
60040 DATAA4,8D,54,4F,4F,20,4D,41,4E,59,20,44,49,4D,45,4E
60041 DATA53,49,4F,4E,53,0D,00,0D,41,52,52,41,59,20,53,49
60042 DATA5A,45,53,20,44,49,46,46,45,52,0D,00,00,00,00,00
60043 DATA00,00,00,00,00,00,00,00
READY.
```

Keith's Utilities

by K Franks

MICROTEX 666

Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

For Apple IIc and IIe computers, the routines allow users to format, boot and 'catalog' disks, as well as delete, lock and unlock files. Instructions are included in the listings.

```
1  ONERR  GOTO 10000
2  POKE 1011,24
10  HOME : VTAB 13: PRINT "KEITH'S UTILITIES       BEST AROUND !!!"
20  FOR I = 1 TO 1000: NEXT I: HOME
30  VTAB 1: PRINT "THE MENU IS :: "
40  VTAB 5: PRINT "     1)- INIT DISK "
50  VTAB 7: PRINT "     2)- DELETE FILES "
60  VTAB 9: PRINT "     3)- LOCK FILES "
70  VTAB 11: PRINT "     4)- UNLOCK FILES "
80  VTAB 13: PRINT "     5)- BOOT DISK "
90  VTAB 15: PRINT "     6)- CATALOG "
100  VTAB 17: PRINT "     7)- RUN A FILE "
105  VTAB 19: PRINT "     8)- EXIT THIS PROGRAM "
110  VTAB 22: HTAB 1: PRINT "ENTER A NUMBER BETWEEN 1 AND 8TO MAKE A SEL
     ECTION ";: GET CHOICE$
115 CHOICE =  VAL (CHOICE$)
120  IF CHOICE = 0 THEN  GOTO 110
130  IF CHOICE < 1 OR CHOICE > 9 THEN  GOTO 110
150  ON CHOICE GOTO 1000,2000,3000,4000,5000,6000,7000,9000
160  GOTO 110
1000  REM  --INITALIZE DISK--
1010  HOME : PRINT "ARE YOU SURE YOU WANT TO INITALIZE A     DISK ? ";: GET
     A$
1011  IF A$ = "Y" THEN  GOTO 1020
1012  IF A$ = "N" THEN  RUN
1013  GOTO 1010
1020  HOME : VTAB 13: PRINT "PLEASE PUT IN THE DISK YOU WISH TO INIT ANO
     MAKE SURE IT IS THE CORRECT ONE A9  THIS WILL ERASE ALL DATA ON THE
     DISK !!!"
1030  VTAB 22: HTAB 1: PRINT "PRESS ";: INVERSE : PRINT "RETURN";: NORMAL
      : PRINT " TO CDHTINUE ... "
1040  GET A$: IF A$ < > CHR$ (13) THEN  GDTD 1030
1050  HOME : FOR I = 1 TO 920: PRINT ".";: NEXT I: VTAB 24: HTAB 1: PRINT
     "INITALIZING";: PRINT  CHR$ (13) +  CHR$ (4);"INIT HELLO": VTAB 1: HTAB
     1: FDR I = 1 TO 960: PRINT "*";: NEXT I:: VTAB 24: HTAB 1: PRINT "FI
     NISH INITALIZING ... ";: FOR I = 1 TO 3000: NEXT I: RUN
2000  REM  --DELETE FILES--
2001 H = 1
2010  HOME : PRINT "ARE YDU SURE YOU WANT TO DELETE FILES ?";: GET A$
2020  IF A$ = "Y" THEN  GOTO 2030
2021  IF A$ = "N" THEN  RUN
2022  GOTO 2010
2030  HOME : PRINT  CHR$ (13) +  CHR$ (4);"CATALOG"
2040  PRINT : PRINT "WHICH OF THESE FILES DO YOU WANT TO     DELETE ?? "
2050  PRINT : INPUT ")";FL$
2060  PRINT  CHR$ (13) +  CHR$ (4);"DELETE ";FL$
2069 H = 0
2070  RUN
2000  REM  --LOCK FILES--
3001 H = 2
3010  HOME : VTAB 1: HTAB 1: PRINT "ARE YOU SURE YOUE WANT TO LOCK FILES
     ??";: GET A$
3020  IF A$ = "Y" THEN  GOTO 3030
3021  IF A$ = "N" THEN  RUN
3022  GOTO 3010
3030  HOME : PRINT  CHR$ (13) +  CHR$ (4);"CATALDG"
3040  PRINT : PRINT : PRINT "WHICH PRDGRAH WOULD YOU LIKE TD LOCK ::"
3050  PRINT : INPUT ")";FL$
3060  PRINT  CHR$ (13) +  CHR$ (4);"LOCK ";FL$
3069 H = 0
3070  RUN
4000  REM  --UNLOCK FILES--
4001 H = 3
4010  HOME : PRINT "ARE YOU SURE YOU WANT TO UNLOCK FILES ? ";: GET A$
4020  IF A$ = "Y" THEN  GDTO 4030
4021  IF A$ = "N" THEN  RUN
4022  GOTO 4010
4030  HOME : PRINT  CHR$ (13) +  CHR$ (4);"CATALOG"
4040  PRINT . PRINT : PRINT "WHICH PROGRAH WOULD YOU LIKE TO UNLOCK ::"
4050  PRINT : INPUT ")";FL$
4060  PRINT  CHR$ (13) +  CHR$ (4);"UNLOCK ";FL$
4069 H = 0
4070  RUN
5000  REM  --BOOT A DISK--
5010  HOME : PRINT "ARE YOU SURE YOU WANT TO BDDT A DISK ??";: GET A$
5020  IF A$ = "Y" THEN  GOTO 5030
5021  IF A$ = "N" THEN  RUN
5022  GOTO 5010
5030  HOME : VTAB 11: HTAB 13: PRINT "PRESS ANY KEY"
5040  VTAB 13: HTAB 14: PRINT "TO BOOT THE"
5050  VTAB 15: HTAB 18: PRINT "DISK"
5060  VTAB 17: HTAB 20: GET A$
5070  CALL  -1401
6000  REM  --CATALOC A DISK--
6010  HOME : PRINT "ARE YOU SURE YOU WANT TO CATALOG A DISK?";: GET A$
6020  IF A$ = "Y" THEN  GOTO 6030
6021  IF A$ = "N" THEN  RUN
6022  GOTO 6010
6030  HOME : PRINT  CHR$ (13) +  CHR$ (4);"CATALOG": PRINT : PRINT : PRINT
     "DO YOU WANT THIS ON THE PRINTER IN     SLOT 1 ?? "
6040  PRINT : INPUT ")";A$
6041 A$ =  LEFT$ (A$,1)
6050  IF A$ = "Y" THEN  PRINT  CHR$ (13) +  CHR$ (4);"PR#1": PRINT  CHR$
     (13) +  CHR$ (41;"CATALOG": PRINT  CHR$ (13) +  CHR$ (4);"PR#O": RUN
6051  IF A$ = "N" THEN  RUN
6052  GOTO 6050
7000  REM  --RUN A FILE--
7001 H = 4
7010  HOME : PRINT "ARE YOU SURE YOU WANT TO RUN A FILE ?? ";: GET A$
7020  IF A$ = "Y" THEN  GOTO 7030
7021  IF A$ = "N" THEN  RUN
7022  GOTO 7010
7030  HOME : PRINT : PRINT  CHR$ (13) +  CHR$ (4);"CATALOG": PRINT : PRINT
     : PRINT "WHICH PRDGRAH DO YOU WANT TO RUN ??"
7040  PRINT : INPUT ")";FL$
7050  PRINT : PRINT : INPUT "IS IT IN BINARY ?? ";A$
7051 A$ =  LEFT$ (A$,1)
7060  IF A$ = "Y" THEN Q$ = "B": GOTO 7090
7070  IF A$ = "N" THEN Q$ = "A": GOTO 7100
7090  IF Q$ = "B" THEN  PRINT  CHR$ (13) +  CHR$ (4);"BRUN ";FL$
7100  IF Q$ = "A" THEN  PRINT  CHR$ (13) +  CHR$ (4);"RUN ";FL$
7109 H = 0
7110  RUN
8000  REM  --EXIT THIS PROGRAH--
8010  HOME : PRINT "ARE YOU SURE YOU WANT TO EXIT THIS     PROGRAH ??";
     : GET A$
8020  IF A$ = "Y" THEN  HOME : CLEAR : NEW
8030  IF A$ = "N" THEN  RUN
8040  RUN
10000 Y =  PEEK (222)
10010  IF Y = 4 THEN  HOME : VTAB 13: PRINT "THIS DISK IS WRITE PROTECTE
     D ";: FOR I = 1 TO 3000: NEXT I: RUN
10020  IF Y = 6 AND H = 1 THEN  PRINT "THAT PROGRAH IS NDT DN THIS DISK
     !! ";: FOR I = 1 TO 3000: NEXT I: GOTO 2030
10021  IF Y = 6 AND H = 2 THEN  PRINT "THAT PROGRAM IS JUST NOT THERE !!
     !";: FDR I = 1 TO 3000: NEXT I: GOTO 3030
10022  IF Y = 6 AND H = 3 THEN  PRINT "I AM SORRY BUT THAT PROGRAM ISN'T
     HERE!!";: FOR I = 1 TO 3000: NEXT I: GOTO 4030
10023  IF Y = 6 AND H = 4 THEN  PRINT "THAT PROGRAM ISN'T ON THIS DISK !
     !! ";: FOR I = 1 TO 3000: NEXT I: GOTO 7030
10030  IF Y = 8 THEN  HOME : VTAB 13: PRINT "INPUT / OUTPUT ERROR ";: FOR
     I = 1 TO 3000: NEXT I: RUN
10040  IF Y = 10 THEN  HOME : VTAB 13: PRINT "INPUT / OUTPUT ERROR": FOR
     I = 1 TO 3000: NEXT I: RUN
10041  IF Y = 10 AND H = 2 THEN  PRINT "THAT PROGRAM IS JUST NOT THERE !
     !!";: FOR I = 1 TO 3000: NEXT I:3030
10042  IF Y = 10 AND H = 3 THEN  PRINT "I AM SORRY BUT THAT PROGRAH ISN'
     T HERE!!";: FOR I = 1 TO 3000: NEXT I: GOTO 4030
10043  IF Y = 10 AND H = 4 THEN  PRINT "THAT PROGRAM ISN'T ON TXIS DISK
     !!! ";: FOR I = 1 TO 3000: NEXT I: GOTO 7030
10050  IF Y = 255 THEN  PRINT : PRINT "";:Y = 0: RESUME
10060  RESUME
```

IBM Pascal directory

MICROTEX 666

Still keying in programs? Forget it! This program is available for telesoftware downloading on Microtex 666 (page *6663#.)

Turbo Pascal lacks the ability to directly load the DOS's directory from within an executing program. The listing below includes a Pascal routine (LOADDIRECTORY) and a demonstration program to print out a directory listing on an IBM PC or compatible.

(Unfortunately, we've misplaced the name of the author of this routine. Anyone recognising this as their own work should call our Sydney office to arrange payment — Ed)

```
{ Program to demonstrate use of loaddirectory procedure by printing
out a directory listing.  Use of wildcards and the perimiter string
is supported.                                                       }

type anystring = string[32];
     direntry = record
                  attribute:byte;
                  time      :integer;
                  date      :integer;
                  sizelsw   :integer;
                  sizehigh  :integer;
                  name      :array[1..13] of byte;
                end;
var directory             :array[1..256] of direntry;
    temp,filecount,count :integer;
    filespec              :anystring;
    size,ts               :real;

procedure loaddirectory(filespec:anystring);
{ this procedure loads all directory entries matching the filespec into
the array defined above.  filecount in set to the number of matches found}
var dtaseg,dtaofs,destseg,destofs,temp,count:integer;
    registers:record
                ax,bx,cx,dx,bp,si,di,ds,es,flags:integer;
              end;  { see turbo pascal manual for details on how to    }
    error:boolean;  { call msdos functions.see dos technical   }
                    { reference manual for details of each routine called }

begin
    with registers do
    begin
        ax:=$2f shl 8;
        msdos(registers);
        dtaseg:=es;
        dtaofs:=bx;
    end;
    with registers do { get firest matching filenames of the disk }
    begin
        ax:=$4e shl 8;
        ds:=seg(filespec); { get segment and offset addresses of name }
        dx:=ofs(filespec)+1;{ add one to go past length of byte }
        cx:=0;
        mem[ds:dx+length(filespec)]:=0; {terminate name with a null }
        msdos(registers);
    end;

    filecount:=0;
    if not odd(registers.flags) then {if carry set there has been an error }
    begin                            { so dont continue }
        repeat
            filecount:=filecount+1;
ddress)     destseg:=seg(directory[filecount]); { get destination segment & a
            destofs:=ofs(directory[filecount]);
 are )      count:=20;                          { skip the first 20 byte, they
            repeat                              { reserved for msdos }
              count:=count+1;
              temp:=mem[dtaseg:dtaofs+count];  {code entry into buffer }
              mem[destseg:destofs+count-21]:=temp; { then blank out rest of }
            until (count>30) and (temp=0);       { our buffer }
            for count:=count to count+(42-count) do
              mem[destseg:destofs+count-21]:=0;
            registers.ax:=$4f shl 8;
            msdos(registers);                    { get next match }
            if odd(registers.flags) then         { check for error }
            error:=true
            else error:=false;
        until error;                             { error means there are no }
    end                                          { more matches }
  else write('File not found ');
     { this error is printed if the first call generated an error }
  end;

function convertdate(dt:integer):anystring;      { convert files date }
var temp:integer;
    st,st2:anystring;
begin
      str(dt mod 32,st2);
      if length(st2)=1 then st2:='0'+st2; { put in leading zeros }
      st:=st2+'/';                        { and slashes }
      temp:=lo(dt) div 32;
      if odd(hi(dt)) then temp:=temp+8;   { refer to tech. man. for more }
      str(temp,st2);                      { details of storage format }
      if length(st2)=1 then st2:='0'+st2;
      st:=st+st2+'/';
      str(hi(dt) div 2+1980,st2);
      if length(st2)=1 then st2:='0'+st2;
      st:=st+st2;
      convertdate:=st;
end;

begin
     if paramcount=0 then filespec:='*.*' else filespec:=paramstr(1);
     { if there is a parameter get it else use the wildcard }

if pos('.',filespec)=0 then filespec:=filespec+'.*';
{ if there is no extention then add a wildcard extention }

loaddirectory(filespec); {load in all matching entries }
for filecount:=1 to filecount do { and print them out}
   begin
      for count:=1 to 13 do write(chr(directory[filecount].name[count]));
      write('      ',convertdate(directory[filecount].date));
      ts:=directory[filecount].sizelow;
      if ts<0 then
         ts:=ts+65536.0;{ts}                     { convert to unsigned}
      size:=65536.0*directory[filecount].sizehigh+ts;
      { the size is 32 bits so we must put the result in the real }
      write(size:8:0, { justify and exclude decimal places }
      writeln;
   end;
end.
```

VZ Frog

by A Alley

Frog begins with a brief instruction screen and asks for the difficulty level (1 to 5). The program then draws a scene of the swamp with the full moon, several water plants and a large frog. Unfortunately, this frog is suffering from a permanent energy crisis. You, as the player, must try to keep him alive by making him eat as many of the insects flying around as possible. This requires a good deal of energy, and so too many misses will result in the frog's untimely demise. The insects get smarter as the game proceeds, and tend to duck out of the way just before the frog eats them.

```
10 CLS:PRINT:PRINTTAB(10)"[redacted]"
20 PRINTTAB(14)"[BY]":PRINTTAB(9)"[ANDREW ALLEY]":PRINT
30 PRINT" CATCH THE BUGS FOR POINTS AND"
40 PRINT"  ENERGY. USE <RETURN>,<[]>AND"
50 PRINT"  <SPACE> TO CONTROL THE FROG.":PRINT
60 PRINT"   PRESS ANY KEY TO CONTINUE":FORT=1TO10:I$=INKEY$:NEXT
70 IFINKEY$="",70
100 CLEAR400:DIMA$(2,5),B(2),B1(2),C(2),C1(2),H$(7),HS(7)
110 FORT=0TO7:H$(T)="????????????":HS(T)=250:NEXT
200 DATA"[redacted]","[redacted]"
210 DATA"[redacted]","[redacted]"
220 DATA"[redacted]","[redacted]"
230 DATA"[redacted]","[redacted]"
240 DATA"[redacted]","[redacted]"
250 DATA"[redacted]","[redacted]"
260 FORT=0TO5:FORU=0TO2:READA$(U,T):NEXTU,T
270 TI=200:RN=6:SC=0:FORT=0TO2:B(T)=28672:C(T)=RND(12)+10:NEXT
275 CLS:PRINT:INPUT"DIFFICULTY 1-5";DF:IFDF<1ORDF>5,275
277 DF=(10-(DF*2))+20
280 POKE30776,255
310 FORT=28672TO29151:POKET,128:NEXT:COLOR5
320 PRINT@26,"[redacted]";
325 PRINT@58,"[redacted]";
330 PRINT@92,"[redacted]";
335 PRINT@127,"[redacted]":COLOR2
340 PRINT@417,"[redacted]";
345 PRINT@448,"[redacted]";:COLOR5
350 PRINT@349,"[redacted]";
355 PRINT@380,"[redacted]";:COLOR1
360 PRINT@413,"[redacted]";
365 PRINT@446,"[redacted]";
370 PRINT@479,"[redacted]";
390 FORT=29152TO29183:POKET,175:NEXT:COLOR1
392 PRINT@32,USING"####0";SC
395 FORT=0TO5:PRINT@T*32+259,A$(0,T);:NEXT
397 FORT=1TO10:I$=INKEY$:NEXT:IFSC>50,450
400 IFINKEY$=CHR$(13),800
410 IFINKEY$=":",900
420 IFINKEY$=" ",950
430 TI=TI-.5:PRINT@0,USING"#####";TI;
440 IFTI<=0,2000
450 FORT=0TO2:POKEB(T)+C(T),128
460 IFB(T)<28864,B1(T)=32:GOTO510
470 IFB(T)>29056,B1(T)=-32:GOTO510
480 IFC(T)<10,C1(T)=1:GOTO510
490 IFC(T)>26,C1(T)=-1:GOTO510
500 IFRND(INT(RN))=1,B1(T)=(RND(3)-2)*32:C1(T)=RND(3)-2
510 B(T)=B(T)+B1(T):C(T)=C(T)+C1(T)
520 POKEB(T)+C(T),120+RND(8)*16:NEXT:POKE28671,1:POKE28671,2
530 GOTO400
800 FORT=0TO5:PRINT@T*32+259,A$(1,T);:NEXT
810 FORT=0TO5:PRINT@T*32+259,A$(2,T);:NEXT
820 S=28967:C=1:GOSUB1000
830 FORT=0TO5:PRINT@T*32+259,A$(1,T);:NEXT
840 GOTO395
900 FORT=0TO5:PRINT@T*32+259,A$(1,T);:NEXT
```

the acclaimed bargain of 1986

popcorn T.M.
S O F T W A R E

A NEW COMPANY
featuring
ALL NEW PRODUCTS
with
A FRESH NEW CONCEPT

popcorn writer T.M.

popcorn desktop T.M.

popcorn misspeller's a dictionary T.M.

popcorn writer T.M.

- Complete Wordstar™—like word processor
- Mail List Merge : read data files and merge with documents
- Block copy, move, write, read, delete
- Global search and replace
- Printing controls : Margins, headers, page numbers and footings
- Text justification : Word wrap, indent
- Powerful undelete function
- On-line help screens
- Cursor control: by character, word, line, page or document

Suggested Retail **$69.96**

popcorn desktop T.M.

- RAM resident, just hit the Hot-key and the Desktop is available
- Calculator : Memory, fixed or floating decimal, percent, square root, export result to application
- Notepad : screen editor with Wordstar™—like commands, global search and replace, import display to notepad
- ASCII Table : fast reference, forward and backward scroll
- Calendar : View by month or year
- On-line help screens

Suggested Retail **$49.95**

Runs on MS-DOS and PC-DOS
Supports colour and monochrome monitors
Requires 128K Bytes of RAM.
Large Dictionary requires 256K Bytes RAM

popcorn misspeller's a dictionary T.M.

- 7,000 word misspeller's dictionary
- RAM resident, just hit the Hot-key and the dictionary is available
- 19,000 word reference dictionary
- Create your own dictionary
- Export words directly to applications
- Direct word search or scroll
- Add or delete dictionary words
- On-line help screens

Suggested Retail **$29.95**

ORDER FORM

Send this completed form to the sole Australian Distributor:—

Cybernetic Research Limited
4th Floor, 464 St. Kilda Road,
Melbourne Vic. 3004.
Tel: (03) 267 8888
Tlx: 39741 ASIPAC
Fax: (03) 267 4981

VISA MasterCard

Payments can be by cheque or all major credit cards

NAME: .....

ADDRESS: .....

..... POSTCODE: .....

Please send information only ☐

Please supply: Popcorn Writer *Quantity* ( )
Popcorn Desktop *Quantity* ( )
Popcorn Dictionary *Quantity* ( )

Card No: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Expires: / /8

Computer type: .....

PROGRAM FILE

```
910 S=28999:C=1:GOSUB1000
920 GOTO395
950 S=29031:C=1:GOSUB1000
960 GOTO395
1000 S=S+1:C=C+1:IFPEEK(S)<>128,GOTO1100
1005 POKES,188:TI=TI-1:PRINT@0,USING"#####";TI;
1008 IFTI=<0,2000
1009 POKE28671,1:POKE28671,2
1010 IFC<20,1000ELSEPOKES,128
1020 S=S-1:C=C-1:POKES,128:IFC<=2,RETURN
1025 POKE28671,1:POKE28671,2
1030 GOTO1020
1100 FORT=0TO2:IFS=B(T)+C(T),SC=SC+1:TI=TI+DFELSE1120
1110 B(T)=28672:C(T)=RND(12)+10:SOUND30,1;31,1
1115 PRINT@32,USING"####0";SC;:RN=RN-.025:IFRN<2,RN=2
1120 NEXT:POKES,128:GOTO1020
2000 POKES,128:S=S-1:C=C-1:IFC<=1,2005ELSE2000
2005 SOUND4,1;0,1;4,1;0,1;4,6;6,4;8,5;0,1;9,4;0,1;6,4
2010 SOUND0,1;8,4;0,1;4,6
2040 PRINT@259,"▀▀▀▀";
2050 PRINT@291,"▀  ▀";
2060 PRINT@323,"▀  ▀";
2070 PRINT@355,"▀  ▀";
2080 PRINT@387,"▀▄▄▀";
2090 PRINT@419,"▀▀▀▀";
```

```
2095 FORT=1TO2000:NEXT
2100 POKE30776,40:IFSC*10>HS(7),2200
2110 CLS:PRINT
2120 PRINTTAB(11)"HIGH SCORES"
2130 FORT=0TO7:PRINT@136+T*32,H$(T);
2140 PRINT@150+T*32,USING"#####";HS(T):NEXT
2160 PRINT@418,"PRESS ANY KEY TO PLAY AGAIN"
2170 FORT=1TO10:I$=INKEY$:NEXT
2180 IFINKEY$="",2180
2190 GOTO270
2200 CLS:PRINTTAB(11)"HIGH SCORES"
2210 FORT=6TO0STEP-1
2220 IFSC*10>HS(T),HS(T+1)=HS(T):H$(T+1)=H$(T):F=T
2225 NEXT
2230 PRINT:PRINT" PLEASE ENTER YOUR NAME ON THE"
2240 PRINTTAB(12)"SCORE BOARD"
2250 INPUTH$(F):H$(F)=LEFT$(H$(F),12):HS(F)=SC*10:GOTO2110
```

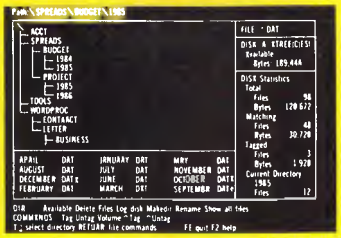
APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer. Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program listings to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface. We will try to return submissions if they are accompanied by a stamped addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of $20 per page of published listing. Programs APC, 215 Clarence Street, Sydney 2000.

NEW SOFTWARE FROM USA

IF YOUR COMPUTER HAS A HARD DISK...



You need the new standard for File and Directory Management

XTREE simplifies file and directory handling by providing single keystroke commands to access, delete, rename, view, move, list, or show all files within any and all directories. XTREE displays a graphic picture of your directory organization, instantly shows all the files in each directory or all files across all directories. Easy to use, just point with the arrow keys (full scrolling and paging in all windows) and press a key. Menu clearly displayed at all times.

FEATURES

- ★ Shows **ALL** files or groups of files in **ALL** directories in one sorted display.
- ★ Copy, delete or rename multiple files in different directories in **ONE** operation.
- ★ ALL vital disk and directory statistics updated and on screen at all times.
- ★ Rename any sub-directory.
- ★ Multiple file rename with wild cards.
- ★ Change volume name without reformatting.
- ★ Full scrolling and paging in file and directory windows.
- ★ Quick and easy location of all directories and files.
- ★ Automatically copies groups of files across several diskettes.
- ★ Documentation written in clear, concise English.
- ★ **NOT** copy protected.
- ★ List files matching any file specification.
- ★ Sort files by name, size, extension or time and date.
- ★ Move files quickly from one directory to another.
- ★ Print out all files on entire disk — organised by subdirectory including name, size, date, etc.
- ★ View contents of all your files.
- ★ On line help screens.

REQUIREMENTS: IBM PC, XT, AT or compatible with 192K and MS-DOS 2.0 or PC DOS.

ONLY $99

Send coupon NOW!

XTREE is a trademark of Executive Systems, Inc.

To: **Perfect Information (Australia) Pty. Ltd.**
P.O. Box 946, Crows Nest NSW 2065
Phone (02) 957 6686 or (02) 92 7777

Please send me _____ XTREE's at $99 each. *Plus $5.50 overnight express freight*

I enclose my cheque for $_____ or please debit my American Express, Diners Club, Visa, Mastercard or Bankcard.

Card expires _____ Signature _____

Name _____

Address _____

_____ Postcode _____

Phone No. _____

APC 2-86

Brother.
Pioneering information processing.

The Brother name in printers stands for advanced technology, revolutionary new features, design excellence and proven reliability at a reasonable price. Just two machines that meet this criteria are the Brother M1509 and the Twinriter 5 (HR35DD).

Brother Twinriter 5.
The world's first Daisy Wheel & Dot Matrix printer.

Now you can have two printers — Daisy Wheel and Dot Matrix, for the price of one.

Features: 140 cps dot matrix type and graphics
- 36 cps letter quality daisy wheel print
- 3K byte buffer memory (optional 11K or 19K byte)
- 136 columns
- 420 cms (16.5 inches) paper width
- Centronics Interface with optional RS-232C converter
- Interchangeable daisy wheel cassettes.

The new Brother Twinriter 5. Two of the best printers money can buy.

Brother M1509.
High Speed Dot Matrix printer.

This new printer is not only very fast and very quiet, it's also very inexpensive.

Features: High Speed output (180cps)
- Near Letter Quality printing (45cps)
- Big 3K byte buffer memory
- Dual Interface (Centronics, RS232C)
- IBM plus Epson Compatibility built-in
- Optional cut-sheet feeder
- Compact and lightweight
- Optional NLQ font board available (LQ-200)
- High Density Charts and Graphics Printing.

Brother M1509 — Value that speaks for itself.

brother®

Pioneering Information Processing

7-9 Khartoum Road North Ryde NSW 2113

SYDNEY (02) 887 4344 • MELBOURNE (03) 873 3655 • BRISBANE (07) 52 5257 • ADELAIDE (08) 42 6373 • PERTH (09) 478 1955. 4398APC

Brainstorm COMPUTER WAREHOUSE

FOR ORDERS CALL
(02) 212 1622
MAIL VIATEL TO: 221216220
See Viatel List On *2489#

3rd Floor
405-411 Sussex St,
Sydney, 2000

P.O. Box K109,
Haymarket
Telex: 70208 Campex

Bankcard, Visa, Mastercharge and Amex credit cards

We GUARANTEE the lowest prices on software and hardware and this is our special offer ...

Order from us any new software or hardware item currently advertised in any popular computer publication and we'll beat thee advertised price by at least $10.

PLEASE NOTE: This offer is made subject to stock availability and does not apply to orders under $100.

All prices subject to change without notice. Delivery extra. All products carry full warranty and support.

IF YOU CAN FIND A LOWER PRICE, WE'LL BEAT IT BY AT LEAST $10!

IBM Software

Open Access	$625
Borland	call
Clipper Compiler	$749
dBase II	$479
dBase III	$662
Framework II	$749
Wordstar 2000+	$479
Lotus 1-2-3	$569
Symphony	$769
Supercalc 3	$549
Super Project	$489
Attache series	call
Integrity series	call
Q + A	$449
Knowledgeman 2	$715
Harvard Total Prg. Man	$540
SPSS/PC	$1385
Foxbase	call
Reflex	call
Dataflex	$1155
more more more	call
Utilities	
Copywrite	$94
Norton Utilities V3.1	$139
Copy II PC	$79
XTree	$89
PC Alien	$79
Smartkey II	$75
more more more	call
Entertainment	
Kings Quest II	$75
Jet	$87
Flight Simulator	$87
Ancient Art of War	$69
Sargon III	$69
Gato	$72
Infocom Games	call
Strategic Simulations	call

Hardware

Hard Discs	
20mb Miniscribe, Tandon, Seagate inc. Controller and cables	$1179
Qubie 20mb w/softw + cont.	$1289
Tuliu ½ ht. from	$1199
Atasi 70mb + Adaptec contr + cables	$3592
Atasi 40mb	$2392
Tape Backups	
Irwin 10mb internal $889 external	$1444
20mb internal	$999
Mountain Tape b/u from	$2364
Amazing!! Bernoulli Box Removable Hard Disc 10mb Single Drive + cont. call for more details	$4299
Boards etc.	
Intel Above Board w/64k	$589
Qubie 6-pac-plus w/384k and software	$399
Intel 8087/80287 from	$320
AST Boards	call
Microsoft mouse V5	$249
Full range of Graphic Boards more! more! more!	call

Modems

The First Nice Modem RS232 above for C64 inc. VIATEL and Bulliten Board s/w	$269
Full range of Case.	$299
Datacraft modems	call
Auto Ice Modem (Apple) internal + s/w	call
Interlink modem + Viatel s/w for Apple/IBM	$375
Call for more MODEMS and Software for the above	
Data Netcomm PC/in Modem	$599
Nettcomm 2123	$699
Other Netcomm	call

Printers

NEC P5	$1755
P3 (add $240 for colour)	$1195
P2 (add $240 for colour	$979
Silver Reed	call
NEC Spinwriters	call
NEC Spinwriter Elf	$726
Star Genisis	$445
Full range of Star printers available	call
CITOH	call
IBM	call
EPSON GX80	$429
EPSON LX80	$465
EPSON FX85	$769
EPSON FX105	$985
EPSON LQ1500	$1675
EPSON SQ2000	$2555
Brother M1109	$399
M1509	$659
Twinwriter	$1595
HR Series	call
Olympia NP165	$485
We sell printers for every occasion	call!
Toshiba P1340	$849
P1351	$1425
P351	$1655
P1015	$699

Discs

Xidex SSDD 5¼"	call
DSDD 5¼	$39.95
Le Floppie DSDD 5¼"	$29.95
Nashua SSDD 5¼"	$35.50
Memorex	call
Fuji 3.5" SSDD	$55
Fuji 3.5" DSDD	$79
Fuji 5¼" DS Quad Dens.	$72
Fuji 8" SSSD or DSSD soft sect.	$53

Monitors

DTX RGB for Apple/IBM + Green/Amber text	$625
Taxan TTL Amber	$329
SuperVision III	$769
Vision IV (25Mhz)	$939
Thompson Green/Amber	$269
Thompson V114" RGB w/ Green/Amber Text	$660
High res CAD/CAM (1024 x 1024) Boards and monitors available. Call for details	

PRICE, SERVICE AND ADVICE ... here's the proof!

When you buy from BRAINSTORM you buy from the experts who regularly service the computing needs of some of Australia's leading companies ...

AWI, GIO, BHP, CSIRO, Taronga Park Zoo, McNair Anderson, PA Consulting, University of NSW, Sydney, Perth, SA, Monash University, Education Department, Department of Public Service, Wollongong City Council and many, many more that would take pages to list.

Also full range of Apple, Commodore software/hardware

Computer Systems

Toshiba T1100 inc. Power Supp., System kit, Manuals 1 external 3.5" or 5¼" (add $40) drive	$2955
Olivetti M24 640k 2 drives mono green or amber	$3775
Olivetti M24 20mb hard disc 1 floppy drive 640k. Amber or green hires screen parallel and send parts	$4885
Osborne PC 2000 2 drives colour or mono card 640k	$2199
This months super special!!! Alantis PC 640k 2 serial, 1 parallel, 2 Mitsibishi drives, 135w power supp. runs 40% faster than IBM PC. 12 months warranty. Colour/mono card, joystick I/F Japanese made boards (colour screen add $525 mono add $120)	$1800
NEC APC III System 1 20mb H. Disc 1 x floppy, 128k SLE Board (to run IBM s/w) colour screen	$6099
System 2 2 x floppy drives, 128k, SLE board	$3549
We sell expansion boards for NEC, IBM, Tandy 1000, MAC + more! IBM/PC/XT/AT/SX	call
other Computers	call

FMS 'C'

Tools for the Professional

Fortrix 'C' $1790
Fortran to 'C' Translator

Bastoc $885
Basic to 'C' Translator

Basic C $309
C source functions which simulate BASIC

Lattice-Window $550
Simple to use multiple full windows for IBM-PC

Lattice db-C $338
ISAM library with DBASE II or III file compatibility

Lattice LMK (UNIX make) $416
Track dependencies. Builds batch files automatically

C Cross Reference Generator $176
Symbol listings and line references

BTRIEVE for PCDOS $467
B-Tree subsystem

PHACT $475
Portable B-Tree subsystem

MSD C Debugger for PCDOS $392
Source level C debugger

PFINISH $523
Execution timing analysis

'PFIX for PC/MS-DOS $384
Multi window debugger

PFIX Plus $716
Symbolic version

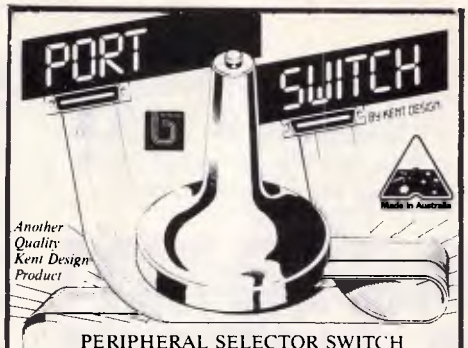
Update your early Microsoft/ Lattice C for $250.00.

Source code available for many products.

FREE C CATALOGUE

Available exclusively in Australia from:

FAGAN
MICROPROCESSOR SYSTEMS
95 Canterbury Road, Middle Park, Vic. 3206
Tel: (03) 699 9899 Telex: AA31604



PERIPHERAL SELECTOR SWITCH
Eliminates need for Multiple Printers — serial or parallel.
FROM **$186** *includes all cables & plugs.*
KENT DESIGN Ph: 509 8751
10 CLAREMONT AVE MALVERN 3144

Protected Software

- Backup
- Hard Disk Use

on

- **Macintosh™**
- **Apple™ II, II/e/c**
- **IBM™ PC, XT & AT**
- **Commodore 64™**
- **PC Tools**

Use Copy II to archive your valuable software to duplicate disk.
One disk drive required.
PC Tools and Mac version have extensive disk utilities for locking & unlocking files etc.
PC and new Mac versions also allow running most popular programs from hard disk without inserting original floppy.

Each version $89.95 incl p&h
Volume discounts apply

Bankcard or Mastercard phone orders: (03) 836 9896
Cheques and form below to:
Great Eastern Software Company, 1st floor, 402 Albert Street, East Melbourne, Vic 3002.

Card No:

Expires: / 8

Computer type: .....

Signature: .....

Name: .....

Address: .....

..... P'code: .....

Product only for use where licence permits.

FMS

Tools for Professionals

Lattice C $770
The 16-bit C Compiler used by the experts. Early version sold as Microsoft C. Version 2.14 includes automatic sensing of the presence of 8087 chip, Unix-compatible maths functions, and more.

Lifeboat's Run $309.00
C Interpreter. Perfect for learning or teaching C and debugging C code. Operates like Basic. 100 common functions built in.

Halo $392
IBM PC Colour Graphics routines: a complete library of graphics primitives for Fortran, Pascal, Lattice C, Basic Compiler, Basic Interpreter, or Assembler. Halo supports the IBM PC Graphics card, the Hercules Card, some other graphics cards, mice and printers. (Price quoted covers one language/card combination.)

Panel $641
A powerful and flexible tool for designing and editing data-entry screens and keyboards. It generates program code in your favourite language for each screen.

PLink-86 ..... $716
A two-pass linkage editor allowing overlays in C, FORTRAN, PL/1, PASCAL, COBOL and Assembler. Define overlays at link time. PLink is available for CP/M-80, CP/M-86 and MS-DOS.

The Greenleaf C Functions $351
This library of functions has its main strength in DOS, string, RS232, color text, and printer functions for the IBM PC. Learn the complexities of C from the examples and source code supplied.

ES/P $467
The Entry System for Programs is the new, third generation program editor that enables programmers to write 50% faster and 100% better. Includes on-line syntax checking, formatting, structure manipulation, and more. Available now for Lattice C.

ASCOM $384
Asynchronous Communications Control Program available configured for over 80 different 8 and 16 bit micros.

Available exclusively in Australia from:

FAGAN
MICROPROCESSOR SYSTEMS
95 Canterbury Road, Middle Park, 3206
Tel: (03) 699 9899 Telex: AA31604

These people are Americans, and we must ask your charity for their sad cause. As you can see, they are driven into hysteria by the sight of an IBM PC. The man on the far right is under the delusion that he is running a hamburger franchise; the man at the far left is practising his Japanese impressions; and the man in the centre has apparently just remembered that pile ointment is meant to be applied externally.

Worse, these are the people behind Chuckle Pops.

Chuckle Pops is a collection of pop-up jokes that sits in an IBM PC, and can be called up at any time from within any program.

Fed up with a 1-2-3 model? Hit Alt-J and you will see, in its own window:

"A father was discussing business ethics with his son who had just graduated college. 'Suppose a woman came into the store,' the father began, 'and bought $100 worth of goods. As she is walking out the door, you discover she'd given you two hundred-dollar bills instead of one. So here's the ethics question. Should you or shouldn't you tell your business partner?"

Yes indeedy; Chuckle Pops, according to our information, 'temporarily suspends the program you're working with, and offers a refreshing rib-tickler instead.' Then, 'with a few snickers under your belt, you can return to your work.'

The program costs $14.95, with hundreds of jokes of which the above is a typical example.

These people need help. Please give generously.

S·A·M·

COMPUTER PHONE ANSWERING MACHINE AND PHONE MANAGEMENT SYSTEM FOR IBM PC & COMPATIBLES

S.A.M. is an advanced telephone management product, carefully designed to enhance the effectiveness of your personal communications. The package includes all the hardware and software required to transform your IBM-PC into an intelligent telephone answering and voice messaging system.
S.A.M. features all the operating functions and ease-of-use normally associated with conventional answering machines, **PLUS...**

```
—S.A.M.— It is 10:35:22A 9-25
Press Letter to Select Option Anytime   Perform the following (➡)

(M) Machine Activate                    ➡Record Answering Message
(R) Review                              ➡Play Answering Message
(S) Set Date and Time
                                        Pick up receiver for Record/Play
(A) Answering Message                   Use '↑' or '↓' to Select Function
(P) Personal Message                    Then press 'Return' to Activate
(F) Forward Messages                    Wait for the beep to record
(T) Timed Message                       'O' on Telephone Ends Record/Play
(O) Other Options
(Q) Quit

Event   Description                                   Time      Date
  0     C:Answer M.000 old message                    5:5128P   9-24
  1     C:CMessage.002 old message                    6:4315P   9-24
```

PERSONAL MESSAGING: Up to 999 separate messages can be retreived individually by callers using their personal access codes

STORAGE: S.A.M. uses digitising techniques to record voice on your disc and reproduces real voice, comparable to if not better than a tape recorder.

MESSAGE FORWARDING: If required, S.A.M. will instantly forward all received messages to you at another telephone number. This function may be turned on, off or set to another destination by remote access.

PHONEBOOK: S.A.M. has an internal phonebook, configured as a multi-field sortable database. This is linked to the message delivery features and also provides single stroke key dialling of up to 250 different telephone numbers.

ACTIVITY LOG: S.A.M. records the time, date and description of all activities for easy reference.

EASY TO INSTALL AND USE: S.A.M. simply plugs into a spare slot on your PC, connect to the phone line, install software and your phone management system is ready to go.

THERE ARE MANY OTHER FEATURES:
Please call us for more information.

ONLY $899 incl. tax

VoiceCommand

VOICE RECOGNITION SYSTEM FOR IBM PC

AT LAST there is available a voice recognition system that provides a 32,000 word capability in 500 word instant recognition segments — all at an affordable price.

SIMPLE UNIVERSAL INTERFACE: VoiceCommand creates a universal interface to operating systems and application programs, translating the spoken word into computer commands for these systems and programs. All PC/DOS and MS/DOS can be used with VoiceCommand.

VOICE AND KEYBOARD MIXTURE: Voice commands, spoken into a standard microphone, activate the computer as if the commands had been entered on the keyboard. Voice and keyboard commands may be used at the same time, allowing full control of all aspects of each program.

EASY TO INSTALL: Simply plug the VoiceCommand interface card into a spare slot on your PC, plug in the microphone, initialise the Executive System with software and you are ready to go.

EASY TO TRAIN: It is easy to train your computer to accept the spoken word. Three or four repititions of the spoken vocabulary constructed for each application produce a workable set of reference patterns. It is easy to use VoiceCommand because there is no complex command code. Non-technical users may define there own vocabulary.

APPLICATION: There are many uses for a reliable voice recognition system. For example, it will increase productivity, quality control, for computer users with RSI or other disabilities, ideal in surgeries and offices where data can be inputted at the same time as other manual tasks are being performed.

ONLY $1,900 incl. tax

System Capabilities

- 32,000 word vocabulary
- 500 word instant-recognition segments
- Standard microphone jack
- Compatible with MS/DOS and PC/DOS software
- Discrete utterance recognition
- Four levels of control for various types of speakers and/or microphone sensitivities
- Multiple Users

We accept Bankcard, Visa, Mastercharge, and Amex, credit cards.
All prices subject to change without notice. Delivery Extra.

BRAINSTORM COMPUTER PRODUCTS

405-411 Sussex St., Sydney, 2000.
P.O. Box K109, Haymarket. Telex: 70208 Campex

Brainstorm
For products with Imagination

FOR ORDERS CALL
(02) 212 1622
MAIL VIATEL TO: 221216220
See Viatel List On *2489#

CHIP CHAT

ACT SCHOOLS AUTHORITY

COMPUTER SYSTEMS OFFICER

GRADE 3 — APPLICATIONS SOFTWARE MANAGER
32849-35489PA

The ACT Sch Ah a a gaa ebe f bc chg he ACT ad f he f eaed ece. The Offce f he Ah ffe a aed ad chaegg g ee.
The cg ee cde a HP3000/68 ce g PASCAL, fh geea gag agage, IMAGE daabae, a age eaed e cca e ad a ae f Hee Pacad ea ce. Aca e cde Pee, Face ad Sde Recd Keeg.
DUTIES: Ude ed e, aage he ace f e Aca Sfae ce. Udeae aa ad gag a f a e ce ae.
QUALIFICATIONS: Eeece he deee, eea ad aeace f ce, e aac ceg e. Faa h daa cca, ffce aa, ea cg ad ced deg eche ae a eed. Aae ea afca ae deabe.
Fhe fa aaabe f M Ma Hd, eehe (062) 469383. T be egbe f ae aca be Aaa ce. Hee, aca h hae eae ede a a be ffeed fed e ee edg he gag f ceh. Cd f ece cde f ee ecea eae aa eae adg, cae c eae ad g ece eae a cehee eaa chee.
Aca, ag afca, eeece ad a cac eehe be, hd be faded b 10 Jaa, 1986 :
RECRUITMENT OFFICER
ACT SCHOOLS AUTHORITY
PO BOX 20
CIVIC SQUARE, ACT 2608

If this job ad were for a cryptographer, we may have thought it was the first part of a clever screening process. But it's not. What it is, though, we're not sure.

There's a free twelve month APC subscription to the best (humorous) explanation. And there's a free subscription also for Wayne Hocking who spotted this mutant advertisement in the Canberra Times. Other computer-related oddities are all welcome.

CHIP CHAT

Memo from Marketing

To: Managing Director,
Australian Personal Computer
(Sales) Pty Ltd
Re: Corporate image

FOR FAVOUR OF YOUR BUSY EYESIGHT
Terribly sorry to bother you and all that, sir, with the football season just a few short months away.

However, there are a few things that you may not quite have extracted the full benefit from, thanks to the inadequate briefings of my colleagues.

The fact that we have sold only one actual computer for the last four months may have escaped your notice, particularly when that inept sales manager of ours tries to give us the number sent to dealers. It's all very well shovelling boxes into dealers' back doors while they are not looking, but eventually even our dealers may begin to notice the growing heap and grunt incoherently down the phone for us to take them away again.

Before that happens, here is my plan.

What we need to do is discover some hardware faults; nothing too drastic, just faulty power supplies or disk drives or something. Then we make loud statements about protecting our users, advising them that buying the current batch of machines could damage their health and fry their finger-ends. Then we hang on a couple of weeks and announce, even more loudly, that the faults have been fixed and it's safe once again to place your orders.

What we get are two batches of free publicity from the brainless trade press, slagging us off for incompetence (which we blame on subcontractors) and then praising us for honesty (which we graciously acknowledge). Then some customers might even get to hear of the machine, visit a dealer, and get conned into buying one of the boxes from the tottering pyramid in the yard.

I know it sounds silly, but IBM or somebody got away with it, or so I hear.

It might even deter our single user from asking for his money back — although with the power supply in his machine, he is more likely to meet St Peter than our customer 'so-called' service division.

In this business presentation counts, and another couple of hardware sales would put us right back into the public eye.

It would be nice to hear you on Willesee expressing your view that Bob is too soft on the unemployed, and laying out the escape route from the world oil price crash crisis via high technology such as your car telephone.

And now that Barry Jones is pundita non-grata, sir, you must be in with a well-deserved chance.
Yours,
Charles

END

A superior multi-user accounting package within reach of every small to medium size business. CBA Accounting Package.

CBA is the accounting package tailored to small to medium size business requirements. It's inexpensive, and yet it's suitable for multi-user operations as well as single. It's compatible with the most popular PC's, AT's and Local Area Networks.

Suitable for so many tasks and so many operating systems

CBA's highly integrated modules cover an extensive range of tasks, including Accounts Receivable/Sales Analysis, Inventory, Order Entry/Invoicing, Accounts Payable, Purchase Orders, General Ledger, Asset Register, Payroll, Cost Management, Bill of Materials and Report Writing. And all these tasks can be run on the world's most popular operating systems, for PC's, AT's and Networks.

Software that adapts to your changing needs

Rest assured that as your needs expand or as hardware is updated, your CBA software package will adapt. With CBA, redundant software is a thing of the past.

Every aid to quick learning and smooth operation

CBA has on-line help screens and tutorial documentation, which means you can pass on operational know-how within your own organisation. It also includes demonstration files as part of the package.

Plus the technical support of Intelligence Australia

In additional CBA users can enjoy the comprehensive back-up facilities of Intelligence Australia, including hardware maintenance, software support, training and consultancy. Start moving towards revolutionising your accounting function with CBA now. Fill in and post the coupon below for further information. Or alternatively, why not ring Intelligence for a demonstration?

"Proven Multi-User on a wide range of systems"

Intelligence

Business computers making sense

Show me how the CBA multi-user Accounting package can streamline my business.

Name:_____

Company:_____

Address:_____

_____

State:_____ Postcode:_____

C B A **Commercial Business Applications**
Better for business... by all accounts

Intelligence Australia Pty. Ltd.
60-64 Shepherd Street,
Chippendale, NSW 2008
Tel: (02) 699 3877

93 King William Street, Hyde Park, SA 5061
Tel: (08) 373 0222

123 Moray Street, South Melbourne, VIC. 3205
Tel: (03) 690 6600

APC

ADVERTISERS INDEX

SPEED UP YOUR IBM PC/XT

Even faster than an AT!

Orchid PCturbo is faster!
PCturbo speeds your system by 200-400%
With the 8087-2 it increases up to 1000%

PERFORMANCE.

With PCturbo 186™ your IBM PC or XT can run 200-400% faster. That's much faster than the AT. It's faster than any other accelerator board, too. And the optional 8MHz 8087-2 makes it faster still.

	Lotus 1,2,3™	Frame-work™	Auto-CAD™
IBM PC	243	90	85
PC AT	84	N.A.*	37
PCturbo 186	82	43	35
PCturbo 186/87	N.A.**	12	23

Benchmark tests. All times in seconds.

**Future version 1.1 of Framework will be AT compatible.*

***Future release of Lotus will support 8087.*

PRICE.

You get more than 100% of the performance for less than 15% of the price.

COMPATIBILITY.

The AT is only 70% compatible with the IBM PC. PCturbo 186 is 100% compatible. So you can run *every* popular PC program.

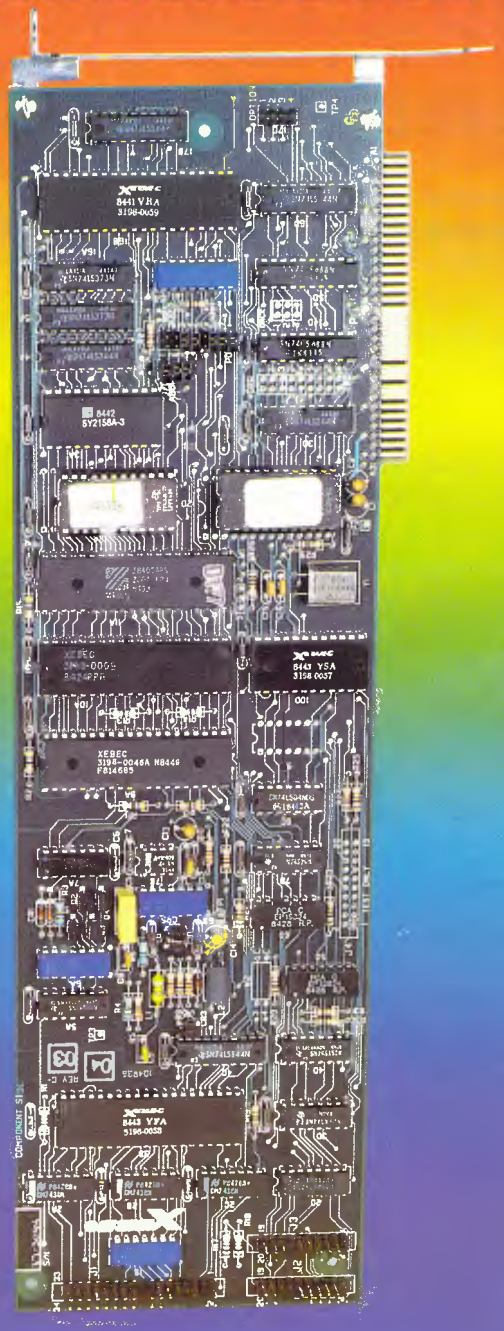
You get more RAM, too. Up to 768K on-board, for a system total of up to 1.4 Mbytes. And PCturbo 186 installs in one simple step.

Sold by:
Computerland
Major dealers

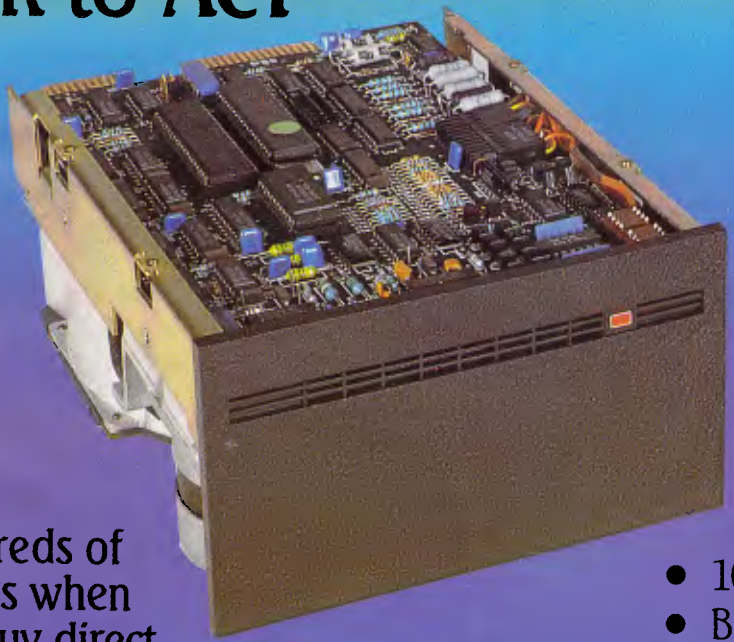
ORCHID
Australian distributor:
Porchester Computers Pty. Ltd.
177 Barkly Street, St. Kilda, 3182.
Telephone: (03) 537 2722.

PCturbo 186 is a trademark of Orchid Technology. IBM PC-AT is a trademark of International Business Machines, Inc. Lotus 1,2,3 is a trademark of Lotus Development Corp. Framework is a trademark of Ashton-Tate. AutoCAD is a trademark of Autodesk, Inc.

An affordable Winchester for your IBM



If you want to talk Winchesters and Controllers... Talk to ACT



SAVE hundreds of dollars when you buy direct from the wholesaler!

FROM **$1395**
(Includes all taxes)

- 10-31 megabytes
- Boots directly to Winchester
- 1 year warranty
- Don't wait months, buy ex-stock
- ACT is an Australian organisation committed to backup support and service

A DIVISION OF AUSTRALIAN PROTECTION INDUSTRIES

act

Australian Computer and Telecommunications
75 Willoughby Road, Crows Nest, NSW 2065.
Telephone 02 439 6300, Telex AA 24816

These are some of our compatibles

In fact Open Access is compatible with more than 25 of the worlds most popular microcomputers.

Open Access is the popular integrated do-it-all super program that can perform virtually every task you're ever likely to encounter.

Open Access includes an electronic spreadsheet, 3D business graphics, word processor, appointment scheduler and telecommunications module, all revolving around the powerful information manager.

Open Access operates on the following MS/PC DOS microcomputers: AT&T, Challenger, Chamellion, Columbia, Compaq, Corona, Datamax, Data General, Digital Rainbow, Eagle, Emtek, Hewlett-Packard, Hyperion, IBM, ITT Extra, Monroe, NCR, NEC, Olivetti, Pantek, Philips, President, Sigma, Sperry, Tandy, TeleVideo, Toshiba, Texas Instruments, Wang, Zenith.

O·P·E·N ACCESS

Produced, distributed and supported in Australia by:

SOFTWARE SUPPLIERS

7 Avon Road, North Ryde, NSW 2113.
Telephone (02) 888 1955. Telex AA 75364

State Distributors
Brisbane (07) 345 2411 Canberra (062) 49 7915 Melbourne (03) 598 4522 Perth (09) 481 0073 Adelaide (08) 219 4615